Volume 3 of 3

Remedial Investigation and Focused Feasibility Study Report

Amtrak Wilmington Maintenance Facility (DE-0170)
Wilmington, Delaware

April 2020

Stantec

Prepared for:
National Railroad Passenger Corporation (Amtrak) and American Premier Underwriters, Inc. (APU)

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EXECUTIVE SUMMARY

This Remedial Investigation/Focused Feasibility Study Report (RI/FFS or Report) presents remedial alternatives which target soil in the Outfall 002 drainage area of the Amtrak Wilmington Maintenance Facility (DE-0170), sediments in the Outfall 002 drainage feature and LNAPL/groundwater in the Maintenance Facility. The remedial goals and remedial alternatives consider Agency (DNREC and USEPA) comments to those proposed for the Former Fueling Facility (DE-0266) portion of the Amtrak Wilmington Shops. National Railroad Passenger Corporation (Amtrak) and American Premier Underwriters, Inc. (APU) retained Stantec to conduct the RI/FFS and prepare this Report. This Report represents the culmination of extensive investigations of the nature and extent of the above contamination and alternative remedies to address that contamination. Soil in the Outfall 007 drainage area of the Maintenance Facility is being addressed in the Former Fueling Facility VCP program since the area drains to the Eastern Drainage Ditch (located within the Former Fueling Facility study area).

The Maintenance Facility and Former Fueling Facility comprise Amtrak's Wilmington Shops, which plays a critical role in passenger rail service on the Northeast Corridor. The Wilmington Shops is Amtrak's only facility for over-hauling electric locomotives. When the assets of the bankrupt Penn Central Railroad were transferred in 1976, the Federal Railroad Administration required Amtrak to execute a 999-year mortgage on all properties, including the Wilmington Shops. Amtrak will control the Site into the future and has plans to continuously occupy the property for railroad operations. There are no uncertainties about how this property will be used in the future. Amtrak plans to record deed restrictions and environmental covenants as part of the Site remedy and include a long-term stewardship plan that is consistent with the selected remedy and future railyard operations.

During the course of their investigation of the Maintenance Facility, Amtrak and APU have implemented a series of interim remedial measures (IRMs) to minimize exposure to, and migration of, contaminants until completion of the RI/FFS process and selection of a final remedy. Erosion control and other mitigation measures were implemented in accordance with the Delaware River Basin Commission's (DRBC's) Pollution Minimization Plan (PMP) program for PCBs. The benefits obtained from these measures have been documented in Annual Progress Reports submitted to DNREC and DRBC. IRMs were implemented within and adjacent to the Administration Building (Building 12) in response to the detection of chlorinated volatile organic compounds (cVOCs; primarily TCE) in sump water, groundwater, soil and indoor air. An enhanced reductive dechlorination (ERD) field-scale pilot test was implemented in the cVOC source area. Performance monitoring data has demonstrated that the implementation of ERD has resulted in significantly lower cVOC concentrations in indoor air, basement sump water and groundwater.

Recommended Remedies

Based on all of the information gathered during this RI/FS process, Amtrak, APU and Stantec recommend that the remedial action for the Maintenance Facility consist of the following components:

(1) **Upland Soils:** (a) Excavate soils with PCB concentrations greater than 100 mg/kg total PCBs (tPCBs) and dispose of all excavated soils having PCB concentrations equal to and above 50 mg/kg at a TSCA-approved facility; and (b) install a TSCA-equivalent cap or Engineered Cover over all of the remaining soils in the Outfall 002 Drainage Area, as described more fully in this Report as Upland Soils remedy WMF-S-1.

(2) **Sediments:** (a) Remove sediments in the Outfall 002 drainage feature to the top of the concrete substrate (this ditch is a relatively small feature encompassing approximately 4,000 sq. ft.); (b) consolidate these sediments, in-situ stabilize and isolate the stabilized material from the environment as part of the sediment remedy for the Former Fueling Facility, as described more fully in this Report as Sediment remedies WMF Sed-1;

(3) **LNAPL/Groundwater**: Implement a Monitored Natural Attenuation (MNA) program to monitor the natural degradation of contaminants remaining in groundwater in localized areas of the Maintenance Facility including the area where the Enhanced Reductive Dechlorination (ERD) pilot program was implemented, as described more fully in this Report as LNAPL/GW Remedy LN-1; and

(4) **Common Elements:** Implement various other remedial measures, as described more fully in this Report as Common Elements.

It is currently estimated that these remedial actions would cost approximately $4,300,000 to implement. As described more fully in this Report, these remedial actions would satisfy all of the remedy selection criteria specified in Table 5-4 of DNREC's HSCA Guidance Manual and EPA's National Contingency Plan. They would be protective of human health and the environment because; as described in the attached Human Health Risk Assessment Report, the implementation of the proposed remedies will meet the remedial goals specified by DNREC and EPA for protection of human health. The installation of TSCA-equivalent caps and engineered covers over all remaining upland soils would further reduce the residual risk to human health from potential exposure to upland soils and would further minimize potential adverse effects to human health and the environment by further mitigating the migration of surface soil to drainage features.

These remedies would comply with all laws and regulations and should be approved by EPA pursuant to the requirements of 40 CFR Section 761.61 (c), which authorizes the approval of risk-based remedies at complex Sites.

These remedies are consistent with the recommended remedies for the Former Fueling

Facility (DE-0266) portion of the Amtrak Wilmington Shops which were selected based on the evaluations presented the June 2017 Revised Supplemental Focused Feasibility Study Report (RSFFS), September 2018 RSFFS Addendum, and the October 2019 RSFFS Addendum 2.

1.0 INTRODUCTION

Stantec Consulting Services, Inc. (Stantec), on behalf of National Railroad Passenger Corporation (Amtrak) and American Premier Underwriters, Inc. (APU), has prepared this Remedial Investigation and Focused Feasibility Study Report (RI/FFS Report) for the Amtrak Maintenance Facility, Wilmington, Delaware (DE-0170) project. The Maintenance Facility portion of the Amtrak Wilmington Shops is located along Vandever Avenue in Wilmington, Delaware (**Figure 1-1**).

A *Revised Remedial Investigation and Focused Feasibility Study Work Plan, Amtrak Wilmington Maintenance Facility (DE-0170), Wilmington, Delaware* (Revised RI/FFS Work Plan) was submitted to Delaware Department of Natural Resources and Environmental Control (DNREC) in April 2012 and *Revised Draft RI/FFS Work Plan Addendum, Amtrak Maintenance Facility (DE-0170), Wilmington Delaware* (RI/FFS Work Plan Addendum) was submitted on June 6, 2012 to address DNREC comments to the Revised RI/FFS Work Plan (refer to **Appendix 1-1** for an electronic version of the Revised RI/FFS Report and RI/FFS Work Plan Addendum). The RI and FFS were conducted under the Delaware Voluntary Cleanup Program (VCP) enacted under 7 Del. C. Chapter 91: Delaware Hazardous Substance Cleanup Act (HSCA).

An Interim Data Submittal – Remedial Investigation (IDS Report) was submitted in March 2015, summarizing the RI activities conducted as outlined in the Revised RI/FFS Work Plan and Addendum. The IDS Report is provided in **Appendix 1-1**. Additional RI activities were proposed in the IDS Report. The additional investigations are summarized in Section 1 of this report. There were no comments from DNREC or United States Environmental Protection Agency (USEPA) in response to the IDS Report.

Remedial alternatives, detailed later in this Report, have been developed using a risk-based approach in accordance with the Delaware HSCA and applicable regulations and guidance (collectively "HSCA"), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Contingency Plan (NCP), the Toxic Substances Control Act (TSCA) and applicable regulations, including 40 CFR 761.61(c) and the Pollution Minimization Plan (PMP) requirements established by the DRBC to implement the Total Maximum Daily Load (TMDL) established for PCBs in the Delaware River Estuary under the Clean Water Act. The human health risk assessment presented in this Report addresses site conditions consistent with the approach used in the human health risk assessment prepared for the Former Fueling Facility (DE-0266). In DNREC's July 26, 2018 letter, the Agencies accepted soil removal targeted to an estimated cancer risk of one in ten thousand (1E-04) and non-cancer hazard of less than 1.0 by target organ system for the hypothetical standard outdoor worker for the Former Fueling Facility (DE-0266). DNRECs July 11, 2019 email correspondence confirmed that it was acceptable to apply the target soil removal goal for the Former Fueling Facility to the Maintenance Facility (DE-0170).

Remediation to a potential cancer risk of 1E-04 (one in ten thousand) to 1E-06 (one in one million) is consistent with the National Contingency Plan (NCP) and *Role of the Baseline Risk Assessment in Superfund Remedy Selection* (OSWER Directive 9355.0-30, April 22, 1991). Additional details of the risk assessment are provided in Section 1.11. Based on the results of the risk assessment, the remedial alternatives presented in this RI/FFS would be protective of human health and the environment.

In addition to the risk-based remedial goals identified above, the remedial alternatives were developed to: 1) eliminate direct contact with residual PCBs and petroleum hydrocarbons in Site soils; and 2) mitigate off-site migration of PCBs from Site soil and sediment in the drainage ditches into Shellpot Creek and the Delaware River Estuary ecosystem. Removal and engineered cover scenarios as well as alternatives that involve addressing site sediments are evaluated. The use of environmental covenants is planned in order to maintain the appropriate level of protection consistent with the human health risk assessment for the future property use.

The Amtrak Wilmington Shops plays a critical role in passenger rail service on the Northeast Corridor. The Wilmington Shops is Amtrak's only facility for over-hauling electric locomotives. When the assets of the bankrupt Penn Central Railroad were transferred in 1976, the Federal Railroad Administration required Amtrak to execute a 999-year mortgage on all properties, including the Wilmington Shops. Amtrak will control the Site into the future and has plans to continuously occupy the property for railroad operations. There are no uncertainties about how this property will be used in the future. Amtrak plans to record deed restrictions and environmental covenants as part of the Site remedy and include a long-term stewardship plan that is consistent with the selected remedy and future railyard operations. The City of Wilmington, DE has zoned the land occupied by the Amtrak Maintenance Shops for industrial use. Other industrial properties surround the Site.

Interim measures have been conducted at the Maintenance Facility including soil removals related to Amtrak's operational improvement activities. The soil actions were performed in accordance with applicable state and federal law, including the Toxic Substance Control Act (TSCA) regulations. In addition, field-scale pilot studies related to constituents in groundwater were conducted. These measures will be discussed in greater detail in this Report.

Operational Units (OUs) have been established in the Maintenance Facility (DE-0170) and Former Fueling Facility (DE-0266) to address remediation of PCB-impacted soil related to infrastructure projects. The list of OUs are summarized below:

- DE-0170
  - OU-1 – Wilmington Maintenance Facility
  - OU-2 – Wreck Track Improvement Project
  - OU-3 – Transfer Table Extension Project

- DE-0266
  - OU-1 – ACS-64 Test/Warranty Center
  - OU-2 – Car Shop Relocation Building
  - OU-3 – Former Fueling Facility
  - OU-4 – Locomotive Tracks 1, 2, and 3 Improvement Project

A PMP (dated September 28, 2005) for the Amtrak Wilmington Shops was prepared in accordance with the DRBC PMP Rule 4.30.9. The PMP was developed and is being implemented to reduce the discharge of PCBs from the Facility. An updated PMP was submitted to DNREC and DRBC on August 30, 2018 for review [as required by the National Pollutant Discharge Elimination System (NPDES) permit for the Facility].

Amtrak and APU have been engaged in both studies of the Maintenance Facility and proactive IRMs to reduce site risks and potential PCB loading from the site while the studies are being conducted. These activities have spanned many years and are reported annually in PMP Annual Reports.

1.1 Report Purpose and Organization

A Draft RI/FFS Work Plan for the Maintenance Facility was submitted in July 2008 (Draft RI/FFS Work Plan). Agency comments to the Draft RI/FFS Work Plan were received from DNREC on April 8, 2009 and from USEPA on October 13, 2011 (provided in **Appendix 1-2**). The Revised RI/FFS Work Plan was submitted on April 10, 2012. Comments to the Revised RI/FFS Work Plan were provided by DNREC and USEPA (the Agencies) on May 18, 2012 and discussions between the Agencies and Amtrak/APU were conducted on June 5, 2012. The Revised Draft RI/FFS Work Plan Addendum was submitted on June 6, 2012. The Addendum was approved by the Agencies in a letter dated June 8, 2012. The reports and correspondence are provided as **Appendix 1-1** and **1-2**.

This RI/FFS Report considers correspondence between the Agencies and Amtrak/APU related to the Former Fueling Facility (DE-0266) located adjacent to and to the south of the Maintenance Facility. The Former Fueling Facility project includes surface and subsurface soil in the Outfall 007 drainage area within the Maintenance Facility footprint. The Outfall 007 drainage area soil was added to the Former Fueling Facility because surface water runoff is directed to the Eastern Drainage Ditch, therefore contributing to the migration of constituents from the Maintenance Facility to the Former Fueling Facility. For the purposes of this RI/FFS Report, the Maintenance Facility soils, groundwater and sediment are summarized in Section 1.7. The human health risk assessment addresses soils in the Outfall 002 drainage area that drains to the Shellpot Creek and groundwater in Outfall 002 and Outfall 007 drainage areas (**Figure 1-2**).

This RI/FFS Report includes the following:

1) The results of additional soil, groundwater and sediment investigations.

2) Risk calculations for the human health risk assessment consistent with the approach for the Former Fueling Facility agreed to (or "approved") by the Agencies in e-mail correspondence dated July 11, 2019;

3) Remedial alternatives for soil (Outfall 002 drainage area) that meet the requirements of the NCP, including PCB remedial options permitted under TSCA by 761.61;

4) Method, results and data collected as part of the field-scale Enhanced Reductive Dechlorination (ERD) Pilot Study for cVOCs in groundwater in the vicinity of Building 3 and Building 12;

5) Remedial alternatives for drainage ditch sediments in the Outfall 002 drainage ditch and NED; and

6) Groundwater modeling for the development of a remedial alternative for cVOCs and Light Non-aqueous Phase Liquid (LNAPL) on the water table and dissolved petroleum constituents in groundwater at the Maintenance Facility.

This RI/FFS Report has been developed in accordance with the HSCA guidelines and is divided into seven primary sections. These sections are described as follows:

- Section 1.0 – Provides a general introduction and background information of the Site, the purpose of this RI/FFS Report, summarizes the findings from previous site investigations, presents a summary of the regional environmental setting; and presents the results of other remedial investigations conducted since the IDS Report was prepared.

- Section 2.0 – Provides a discussion of the Remedial Action Objectives (RAOs), Applicable or Relevant and Appropriate Requirements (ARARs) and Remedial Goals as well as description of site media.

- Section 3.0 – Provides the identification and screening of alternate remediation technologies and process options considered in this RI/FFS Report.

- Section 4.0 – Provides definitions of remedial alternatives considered in this RI/FFS Report.

- Section 5.0 – Presents a detailed evaluation of remedial alternatives considered in this RI/FFS Report.

- Section 6.0 – Presents a summary of and justification for the recommended remedial alternatives.

1.2 Remedial Approach

The remedial approach for the Wilmington Maintenance Facility considers interactions between the Agencies and Amtrak and APU, related to the Former Fueling Facility (DE-0266) June 2017 *Revised Supplemental Focused Feasibility Study Report* (RSFFS), September 2018 RSFFS *Addendum*, and October 2019 RSFFS Addendum 2. Target remedial goals for constituents of potential concern (COPCs) will be consistent with goals established for the Former Fueling Facility (DE-0266). A human health risk assessment (HHRA) for the Wilmington Maintenance Facility (DE-0170) is presented in Section 1.11. The risk assessment is used to support the efficacy of establishing similar remedial goals in the Wilmington Maintenance Facility (DE-0170) as have been agreed upon with the Agencies for the Former Fueling Facility (DE-0266).

The comprehensive screening of potential remedial alternatives presented in the RSFFS and Addendums for the Former Fueling Facility (DE-0266) is provided in **Appendix 1-1**. The FFS for the Wilmington Maintenance Facility portion of the property is summarized in Sections 2 through 6. The FFS screening process is streamlined to focus on utilizing proposed remedies for the Former Fueling Facility in the Maintenance Facility portion of the property.

1.3 Site Background

The following is a description of the site location and operational history.

1.3.1 Site Location and Description

The Amtrak Wilmington Shops is comprised of two facilities: the Maintenance Facility and the Former Fueling Facility (refer to **Figures 1-2** and **1-3**). The Amtrak Wilmington Shops are located in Wilmington, New Castle County; Delaware (refer to **Figure 1-1**). The Amtrak Wilmington Shops are situated in an industrial area of southeast Wilmington and are zoned General Industrial (M-2) by the City of Wilmington. The Amtrak Wilmington Shops were constructed in 1903. Since the original construction, the operations have consisted primarily of the maintenance, service and overhaul of locomotives, rail cars, and railroad equipment.

The Maintenance Facility (Site) is located north of the Former Fueling Facility. The Maintenance Facility is bounded to the east by the Norfolk Southern Edgemoor Yards, to the north by Shellpot Creek, and to the west by active mainline Amtrak track (**Figure 1-3** presents the site vicinity). As indicated in **Figure 1-2** and mentioned previously, for the purposes of this investigation, the Maintenance Facility is considered the Amtrak property north of the former roundhouse (the former roundhouse area was evaluated as part of the Former Fueling Facility remedial investigation). The Maintenance Facility area of investigation encompasses approximately 52 acres; of which approximately 36 acres is paved or under building roof and 16 acres is unpaved. It should be noted that soils located in the Outfall 007 drainage area within the Maintenance Facility were evaluated and included in the RSFFS for the Former Fueling Facility.

1.3.2 Site Operational History

The Maintenance Facility is an active rail yard used primarily for the maintenance of locomotives, and railroad equipment. The primary maintenance activities are performed in the High Bay (Building 7), Locomotive Shop (Building 3), Electric Shop (Buildings 4, 5, and 6), Roadway Component Shop (Building 1A), and the Wheel Shop (Building 37) (refer to **Figure 1-2**). Other activities include the fabrication of concrete forms and track panels. In 1995, fueling operations were moved from the Former Fueling Facility to the Maintenance Facility. A new fueling area with a 10,000 gallon above ground storage tank (AST) was installed.

During previous site investigations, PCBs were detected in soils and surface water as well as in sediment samples collected in the facility storm sewers. The use of PCB equipment at the Maintenance Facility was primarily associated with oils in electric transformers in some locomotives and (self-propelled) passenger cars (equipment containing PCBs is no longer in use at the facility). Several stationary transformers containing PCB dielectric fluids were also in operation at the Site. These stationary transformers were removed by Amtrak by 1983.

PCBs historically were contained in dielectric fluids in the transformers in some locomotives and passenger cars. The maintenance of locomotives was primarily performed in the Locomotive Shop; Car Shop 1 and Car Shop 2 were used primarily for the servicing of passenger cars.

Beginning in the late 1970's and continuing into the 1980's, transformers on locomotives and self-propelled passenger cars were retrofilled to reduce the PCB concentrations in transformer fluids. The PCB fluids were flushed from the transformers and replaced with new dielectric fluids. The flushing involved the use of trichlorobenzene to reduce the PCB concentrations in the transformers. The trichlorobenzene was reclaimed using a distillation process and reused (this operation ceased in the mid to late 1980s).

Currently, the fleet of locomotives serviced at the Maintenance Facility includes electric locomotives (equipped with non-PCB dielectric fluid filled transformers) and diesel locomotives. No equipment containing PCBs, including retrofilled equipment, is in service.

A summary of PCB minimization activities is provided below for operations and equipment managed by Amtrak and based on available records and discussion with Amtrak personnel.

- Stationary transformers containing PCB fluids were removed by Amtrak by 1983. These fluids were incinerated at an USEPA-approved facility.
- Transformer dielectric fluid retrofilling activities were performed in the 1970's and 1980's.
- No equipment containing PCBs is currently in service. Equipment that had been retrofilled has been removed from service.
- The Maintenance Facility sewer systems were reconfigured in the 1980's (refer to Section 2.4). Work pits below cars and locomotives were sealed in the 1980's and connected to the industrial sewer system.
- Asphalt or concrete paving was placed on road surfaces and parking areas reducing the area of uncovered soils.
- Amtrak has performed several soil excavations (and off-site disposal) activities in the Maintenance Facility. These activities related to the Wilmington Maintenance Facility (DE-0170) are included in the discussion below.
- Amtrak has performed PCB minimization activities as part of the PMP program for the Maintenance Facility. These activities are also included in the discussion below.

1.4 Environmental Setting

The following is an overview of the environmental setting, including discussion of site geology/hydrogeology, surface water hydrology and regional environmental setting.

1.4.1 Hydrogeologic Setting

The Site is located within the Atlantic Coastal Plain Physiographic Province and mapped as being underlain by unconsolidated sediments of the Columbia Formation (Quaternary Age). These fluvial sediments generally consist of gravelly, coarse-to medium-grained sands with interbedded silts and clays (Woodruff and Thompson, 1975). The thickness of the Columbia Formation is generally less than 10 feet in the vicinity of the Site. The Columbia Formation represents the water table aquifer in the site vicinity. A Geologic Map of the area is provided as **Figure 1-4**.

The Columbia Formation is underlain by the Potomac Formation (Cretaceous Age) which consists of variegated red, gray, purple, yellow, and white silts and clays containing interbedded sand and some gravel (Woodruff and Thompson, 1975). Because of the proximity of the Site to the Fall Line, the Potomac Formation at the Site is expected to be thin and pinches out along the northwestern portion of the Amtrak Wilmington Maintenance Facility.

The Wilmington Complex (Precambrian Age) subcrops beneath the Columbia Formation along the northwestern portion of the Site. The Wilmington Complex represents the crystalline basement rocks of the northern Delaware area and consists of norite, hypersthene-quartz-andesine gneiss, and noritic anorthosite in the vicinity of the Site (Woodruff and Thompson, 1975). The upper portions of these basement rocks are commonly weathered resulting in a zone of regolith which is reported to be from 20 to 50 feet thick just north of the study area (Christopher and Woodruff, 1982).

The Columbia Formation represents the water table aquifer but is thin in the vicinity of the Site. Groundwater is transmitted through the Wilmington Complex through secondary permeability features (fractures and joints) and is capable of sustaining relatively low yields. Neither the Columbia Formation nor the Wilmington Complex are used as a water source in the vicinity of the Site (refer to Section 2.5).

Eleven monitoring wells were installed during 1980 in the Maintenance Facility area of investigation by Woodward-Clyde Consultants (1981). Woodward Clyde reported that the stratigraphy in three deep wells (well depths ranging from 31 to 35 feet bgs), located in the Former Fueling Facility, the southern portion of the Maintenance Facility, and the northern portion of the Maintenance Facility, was similar. Fine to medium grained sand with gravel was encountered at a depth of 25 to 30 feet below ground surface. This sand unit was overlain by 15 to 20 feet of clayey slit or silty clay with traces of sand and some peat (first encountered at a depth of approximately 10 feet in the two wells in the Maintenance Facility). A layer of peat was identified above the clayey silt/silty clay unit in some wells. The peat when present was overlain by fill. The other wells in the Maintenance Facility were shallow wells installed to a depth of 15 feet or less. Gray clay was also encountered at depths ranging from 3 to 10 feet in the drainage ditch north of the Eastern Drainage Ditch during sediment sampling performed as part of the Former Fueling Facility remedial investigation.

Woodward Clyde Consultants (1981) interpreted that the lower silt sand with some gravel is probably alluvial sediment that may be channels sands of the Delaware River. The clayey silts or silty clays above the channels were interpreted to be over-bank (flood plain) deposits on which marsh vegetation grew over part of the area. Fill was interpreted to have been placed on the marsh deposits in order to provide usable land.

Water table contour maps were prepared by Woodward Clyde Consultants (1981) for data collected on July 29, 1980 and August 27, 1980. These maps indicate that the direction of groundwater flow from the Maintenance Facility is from the Amtrak mainline tracks towards the drainage ditch north of the Eastern Drainage Ditch with components of flow towards Shellpot Creek and Eastern Drainage Ditch in the northern and south portions of the Facility, respectively. It was also reported that water level measurements from shallow/deep well pairs indicated an upward head potential through the silt/clay unit.

Approximately 55 monitoring wells have been installed in the Maintenance Facility as part of the remedial investigations. Groundwater gauging and chemistry at these locations is discussed in the following sections of this RI/FFS Report. A Generalized Hydrogeologic Profile is provided as **Figure 1-5**. Geologic cross sections are provided as **Figures 1-6** and **1-7**.

1.4.2 Surface Water Hydrology

The following is a discussion of the surface water hydrology for the Maintenance Facility. Outfall 002 and Outfall 007 are located in the Maintenance Facility and drain to the Shellpot Creek and Eastern Drainage Ditch, respectively. The surface and subsurface soil in the Outfall 007 drainage area was addressed as part of the RSFFS and Addendums 1 and 2 for the Former Fueling Facility.

The current NPDES permit (DE0050962) became effective September 1, 2017. Prior to September 1, 2017 sampling was conducted in accordance with the previous NPDES permit, effective September 1, 2012. A requirement of the current NPDES permit was the development of an updated PMP. A PMP was submitted to DNREC and DRBC on August 30, 2018. Prior to the updated PMP, Amtrak continued implementation of the PMP for the Site dated August 31, 2013. The current permit expires August 31, 2022 (documentation for NPDES permit renewal has been provided to DNREC).

1.4.2.1 Hydrologic Setting

The ground surface in the Maintenance Facility is generally flat and approximately 36 acres of the 52-acre study area is paved or covered with buildings. Nearly all storm water flow is conveyed through the Facility storm water sewer system (refer to Section 1.4.2.2). Two storm water outfalls (Outfall 002 and 007) are located in the Maintenance Facility and are monitored in accordance with the NPDES permit for the Facility (refer to Section 1.4.2.3). Shellpot Creek flows to the east along the northern boundary of the Maintenance Facility and empties into the Delaware River downstream of the Site (refer to Section 1.4.2.4). Direct surface runoff to the Shellpot Creek occurs along the northern portion of the Facility.

A drainage ditch to the east of the Maintenance Facility separates the Amtrak rail yard from the Norfolk Southern rail yard. In the Former Fueling Facility Phase II RI/FFS, this drainage ditch was referred to as the drainage ditch north of the Eastern Drainage Ditch or "NED" (this ditch also receives storm water runoff from the adjacent Norfolk Southern rail yard). The northern portion of this drainage ditch flows in a generally northerly direction to the Shellpot Creek while the southern portion flows in a southerly direction to the Eastern Drainage Ditch (which eventually flows through two sediment control dams and to Brandywine Creek). The general location of the drainage divide in this ditch is depicted on **Figure 1-8**. The location of the drainage divide may vary as a result of tidal conditions in Shellpot Creek. This ditch also receives runoff from the adjacent Norfolk Southern rail yard and a tank car cleaning operation located to the east of Amtrak property.

1.4.2.2 Maintenance Facility Sewer Systems

Storm water flow in the Maintenance Facility is routed to Outfall 002 (which flows to the Shellpot Creek) and to Outfall 007 (which flows to the Eastern Drainage Ditch). Outfall locations and approximate on-site drainage areas are presented on **Figure 1-8.** Overland flow occurs in the immediate vicinity of the Shellpot Creek in the northern portion of the facility and adjacent to the drainage ditch north of the Eastern Drainage Ditch (NED) in the eastern portion of the Facility.

In addition to the storm sewer system, the water management piping in the Maintenance Facility consists of industrial waste sewers and sanitary sewers. A Facility Piping Plan is provided as **Figure 1-9**. Flows to the industrial waste sewer are routed to the industrial waste treatment building for treatment prior to discharge to the City of Wilmington Wastewater Treatment Plant under an industrial waste discharge permit issued by the City of Wilmington (City of Wilmington Department of Public Works Wastewater Discharge Permit #W-85-04). The permit requires semi-annual monitoring for PCB congeners (EPA's Draft Test Method 1668A) and other parameters. The sanitary sewers, which connect to rest room and locker room facilities, also discharge to the City of Wilmington Wastewater Treatment Plant.

1.4.2.3 NPDES Monitoring Program

There are six outfall locations identified in the NPDES permit for the Wilmington Shops (Outfalls 001, 002, 004, 005, 006, and 007). As noted above, Outfalls 002 and 007 receive drainage from the Maintenance Facility portion of the Site. All of the Site outfall locations other than Outfalls 002 and 007 are located within or adjacent to the Former Fueling Facility portion of the Site. Outfall 003 was removed as an Outfall by DNREC as part of the permit, effective September 1, 2017. As indicated on **Figure 1-8**, Outfall 002 flows into a drainage swale that drains to Shellpot Creek. Outfall 007 flows into a drainage swale that drains into the Eastern Drainage Ditch and is upgradient of Outfalls 001 (Dam B), and Outfall 006 (12th Street Dam) which receives flow from the Eastern and Western Drainage Ditches.

The current NPDES permit (DE0050962) became effective September 1, 2017. The monitoring requirements of the NPDES permit vary by outfall locations and are included in **Appendix 1-3**. The permit requires annual PCB congener analyses from Outfall 006 (Former Fueling Facility), Outfall 002, and Outfall 007. Additional PCB congener analysis was required starting with the September 1, 2017 permit during dry weather at Outfall 002 and Outfall 006. Trichloroethene (TCE) monitoring at Outfall 002 (monitor only) is conducted quarterly during wet and dry weather.

1.4.2.4 Shellpot Creek Watershed

As mentioned, Outfall 002 drains to the Shellpot Creek and Shellpot Creek bounds the northern portion of the Facility. The Shellpot Creek Watershed consists of approximately 6,300 acres of primarily residential and commercial land, situated in northeastern New Castle County, Delaware (refer to **Figure 1-10**). Shellpot Creek headwaters originate at elevation 400 feet and flows approximately seven miles before entering the Delaware River between Cherry Island and Edgemoor, Delaware.

The lower mile of Shellpot Creek is influenced by diurnal tides from the Delaware River. Due to the relatively flat topographic profile of the Shellpot Creek bed, this area functions as a relative "sink" for receiving debris, sediments and water from surrounding areas. Diurnal tidal flow into the creek is attenuated, although not stopped, by a tide gate located approximately 0.25 mile upstream of the confluence with the Delaware River and approximately one mile downstream of the Facility. The attenuation in tidal flow caused by the tide gates has fostered the deposition of sediment and organic detritus in the lower tidal reach of Shellpot Creek. Oxygen demand from decaying organic matter, upgradient nutrient loads and reduced tidal exchange, results in depressed dissolved oxygen concentrations within this portion of the creek during the summer months.

Vegetation within the tidal portion of Shellpot Creek is typified by bands of emergent wetland vegetation on intertidal flats of varying width, grading into large upgradient stands of common reed (*Phragmites australis*). A large area of emergent marsh, with a diverse plant community, is located off of the mainstream creek approximately 0.6 miles above the confluence with the Delaware River.

The bed of the tidal Shellpot Creek consists primarily of silt and clays, with an increasing proportion of sand in the upper tidal reach. Land use adjacent to the tidal portion of Shellpot Creek is primarily industrial with dredge spoils and plant process waste solids stored in filled marsh areas on the south bank of the Shellpot Creek.

A transition area between the tidal and non-tidal portions of the creek is located between the downstream-most Norfolk Southern railroad bridge and the Amtrak main line bridge. This area has a generally non-tidal character, with a moderately incised channel, some riffle/pool segmentation, and a broad mixed deciduous forested floodplain.

The approximate limit of the tide is located immediately upstream of the Amtrak main line bridge. The lower half mile or so of the non-tidal Shellpot Creek is relatively low gradient, with a predominantly sand and gravel substrate. Land use adjacent to this portion of the creek is primarily commercial.

Most of the non-tidal Shellpot Creek has a moderately to deeply incised channel and a moderately steep gradient. The width of the channel narrows with progression upstream. The creek bed substrate reflects the gradient and local geology, and consists primarily of cobble and boulders, with bedrock outcrops and ledges in some areas. The aquatic habitat consists of series of pools, runs, and riffles. The banks of the creek are typically lined by mixed deciduous trees and shrubs. Vegetated riparian buffer areas of varying widths adjoin most of the non-tidal creek. The creek flows through several New Castle County parks, some of which include relatively large wooded tracts.

In a number of locations, sanitary sewer lines occur beneath or adjacent to the bed of the non-tidal Shellpot Creek. Evidence of sewer overflow was observed at a sewer manhole adjacent to the creek immediately downstream of Market Street during a field reconnaissance in October 2005.

Land use adjacent to the non-tidal portion of Shellpot Creek is primarily residential and commercial with increasing residential use in the headwaters areas. The Shellpot Creek Collaboration Project was conducted by Amtrak, APU and DuPont and submitted to

DNREC in November 2006. A summary of that project and potential sources of PCBs in the Shellpot Creek Watershed are provided in **Appendix 1-4** and Section 1.4.3.

1.4.3 Regional Environmental Setting

As previously described, the Amtrak Maintenance Facility is bounded to the north by Shellpot Creek and Outfall 002 drains to Shellpot Creek. This discussion of the regional environmental setting focuses on potential sources of constituents of concern (COCs) to Shellpot Creek based on a previous investigation performed by Secor (now Stantec) which was provided to DNREC on November 20, 2006. Since flow from Outfall 007 drains to the Eastern Drainage Ditch, through two sediment control dams, under 12th Street to Brandywine Creek; a discussion of potential PCB sources along the tidal portion of the Brandywine Creek was provided in the RSFFS Report and Addendum for the Former Fueling Facility.

Secor (now Stantec) was retained by American Premier Underwriters (APU), Amtrak and DuPont to gather information about environmental conditions of the Shellpot Creek and its watershed located near Wilmington, Delaware. Information was collected from readily accessible documents available to the public and site reconnaissance conducted in October 2005. This summary provides an overview of the information collected. A compendium of information, including maps, site files, data and field observations, was prepared in the format of an interactive set of four CD's (Shellpot Creek Collaboration Project, November 2006). The physical characterization of the Shellpot Creek watershed was presented in Section 1.4.2.4.

The project summary and potential sources of PCBs in the Shellpot Creek Watershed are provided in **Appendix 1-4**. Based on the information gathered, an inventory of Sites identified within the Shellpot Creek Watershed at the time of the investigation is summarized below:

- 13 DNREC SIRB Sites
- 45 Hazardous and Solid Waste Sites
- 21 Sites from DNREC programs (Recycling, Wastewater, Salvage)
- 137 UST Sites
- 119 LUST Sites
- 2 AST Sites
- CSO #31 and New Castle County Sewer System

Other PCB data for Sites within the Shellpot Creek Watershed were obtained through reviewing files from DNREC or other sources. The results are described below on a site by site basis (these locations are identified on **Figure 1-10**).

- Amtrak Wilmington Facility
- Conectiv Salvage Yard Relocation Area I
- DuPont Cherry Island (Hay Road facility)
- Purina Tower Area A
- Purina Tower Area B
- Pollution loading from the City of Wilmington Combined Sewer Outfalls (CSO) at CSO #31 (refer to Figure 1-10)

These potential sources are discussed in greater detail in **Appendix 1-4**.

<u>Other Potential Sources</u>

Other releases of PCBs to the Shellpot Creek drainage basin may have occurred after the Shellpot Creek Collaboration Project (November 2006) was prepared. An extensive review was not performed as part of the preparation of this RI/FFS. However, during May 2008, 900 to 1,000 gallons of oil in 1940s-era transformers was spilled by vandals (believed to be dismantling the transformers for their copper wire) at the Merchants Square Shopping Center (refer to **Figure 1-10**) according to an article in the Wilmington News Journal. Oils in 1940s-era transformers likely contained PCBs. The spill location is within the Shellpot Creek watershed.

Numerous environmental studies have been performed to discern the presence, distribution and potential environmental impact and to determine potential upland, updrainage and down-drainage source areas, which upon tidal reversals are impacting the Shellpot Creek drainage basin. Environmental investigations have been performed at specific former industrial properties along the Brandywine Creek. The following are select environmental studies performed at properties located adjacent to the tidal reach of the Brandywine Creek where PCBs have been reported at concentrations ranging from less than 50 mg/kg to over 30,000 mg/kg.

- 12th Street Drum Site (DE-294),
- Atlas Sanitation (DE-280),
- Diamond State Salvage (DE-281),
- Electric Hose and Rubber Site (DE-174),
- 7th Street Drum Site (DE-1148), and
- 1101 8th Street (former Carney-Harris) Site (DE-1397).

1.5 Previous Investigations and Soil Removal Activities

There have been several environmental investigations performed at the Maintenance Facility. A summary of the available information for investigations in the Maintenance Facility was provided in the April 10, 2012 Revised Remedial Investigation and Focused Feasibility Study Work Plan and are also provided in **Appendix 1-1**.

Three large-scale site investigations were performed between 1980 and 1984 to assess site conditions. These investigations were used to identify areas for soil removal activities which were performed in 1984 and 1985. A 1994 investigation performed by DNREC documented sediment sample collection in the drainage ditch on the eastern perimeter of the Maintenance Facility. From 1995 to present, several localized investigations were performed which were prompted by proposed construction of new buildings or expansions to existing structures. A summary of each investigation based on available information for the Maintenance Facility is provided below. Available documentation for the investigations identified below are provided on a thumb drive included in **Appendix 1-1** and **1-2**. **Figure 1-11** presents the extent of previous excavation activities (based on available excavation plans) and proposed excavation areas.

- *Assessment of PCBs at the Wilmington Maintenance Facility* was prepared by Woodward-Clyde Consultants and dated January 30, 1981. This investigation included sampling of various site media (soil, sediment, and groundwater) and included recommendations for site remediation including excavation, capping and covering soils.
- *Analyses of Soil Samples from Amtrak was prepared by Radiation Management Corporation and dated July 1982. This investigation included additional soil sampling. Based on the results of this investigation, three areas were identified for soil removal (refer to **Figure 1-11**).*
- *Radiation Management also conducted soil sampling in 1983 and 1984*
- *During 1984 and 1985, approximately 10,000 cubic yards of PCB impacted soils were removed from areas in and around the Maintenance Facility. Areas where previous sampling identified "hot spots" of PCBs were reported to have been removed. The soil removal was coordinated with the USEPA and state agencies. The proposed excavation areas are included on **Figure 1-11**.*
- *In 1986, approximately 2,000 yards of soils were reportedly removed from the vicinity of the current location of the Wheel Shop (refer to **Figure 1-11**).*
- *A 1989 Preliminary Assessment Report prepared by NUS Corporation provides details of an August 16, 1988 site visit by FIT, EPA, DNREC and Amtrak. No samples were collected, and EPA concluded that "the extensive sampling and cleanup of PCB-contaminated areas, as well as the discontinuation of the use of PCB*

transformers, has minimized concerns for exposure to the environment and for population."

- *During April 1991, a 5,000-gallon kerosene underground storage tank (UST) was removed from an area south of Building #27. The removal of this UST (as well as two USTs from the Former Fueling Facility) was documented in Tank Closure Record Wilmington Maintenance Facility, Vandever Avenue, Wilmington, Delaware (UST Closure Report) prepared by Joseph T. Hardy and Son, Inc., dated May 20, 1991.*
- *In December 1994, Inspection Report on the Amtrak Wilmington Refueling Facility was prepared by DNREC (DNREC, 1994). Sampling was conducted on November 30, 1993 and January 13, 1994 to evaluate potential human health and environmental risks, identify potential target populations/resources, determine potential pathways, and to conclude whether additional investigation was deemed necessary in the Former Fueling Facility.*
- *During 1995, Amtrak performed soil sampling along the track area to the north of Car Shop 1. The sampling was performed in advance of the track replacement/ maintenance project in the area. Soil samples were collected on a grid pattern. Areas reporting PCB concentrations greater than 25 mg/kg were targeted for soil excavation.*
    - Following the sampling mentioned above, Amtrak contracted with Clean Harbors Environmental Services, Inc. (Clean Harbors) to remove soils from the track area north of Car Shop 1. A total of 3,777 tons of material was shipped to Chemical Waste Management's Model City Landfill in Model City, NY (a TSCA facility).

- *During 1997, Amtrak excavated approximately 2,400 cubic yards of material (soil and construction debris) during the construction of an addition to the Wheel Shop.*
- *Summary Report of Soil Removal Activities, Proposed Warehouse Building Area was prepared by Secor (now Stantec) in December 2005 (refer to **Appendix 1-1**). This report detailed characterization soil borings and excavation activities performed in September/October 2005 at the location of a proposed new warehouse building to be located north of Building 33 and adjacent to Building 39 (refer to **Figure 1-11**). A total of 1,137 tons of material was disposed at a TSCA approved landfill. The proposed warehouse building was not constructed.*
- Another proposed building prompted soil characterization to the northeast of Car Shop 1 (Building 1) in September of 2006 (refer to **Figure 1-11**). An area of approximately 130 feet by 180 feet varying in depth from 0.5 feet to 3.0 feet was excavated. Post-excavation samples were also collected (the report of findings is included in **Appendix 1-1**).
- In July and August 2007, a subsurface investigation was conducted by Secor (now Stantec) in the Locomotive/Wheel Shop area. Ten (10) one-inch diameter

piezometers were installed to a depth of approximately 10 feet bgs to evaluate the potential occurrence of light nonaqueous phase liquids (LNAPL) on the water table. *Locomotive/Wheel Shop Areas Subsurface Investigations Report of Findings* dated September 20, 2007 is included in **Appendix 1-1**.

- The March 2015 IDS Report summarized surface and subsurface soil, groundwater, and sediment sampling conducted in the Maintenance Facility per the Revised Remedial Investigation and Focused Feasibility Study Work Plan dated April 10, 2012 including the Outfall 007 drainage area. Additional investigations conducted since the submittal of the IDS Report are summarized in Section 1.6

1.6 Remedial Investigations Through 2014 – Interim Data Submittal

The scope of the remedial investigation for the Amtrak Wilmington Maintenance Facility (DE-0170) was presented in the April 10, 2012 Revised RI/FFS Work Plan and Addendum dated June 6, 2012 (refer to **Appendix 1-1**). The investigation targeted surface soil in unpaved areas and track areas as well as subsurface soil, groundwater, sediment, and surface water. Soil sample locations targeted locations where previous historical investigations identified residual concentrations of PCBs. Historical facility operations were also reviewed and was considered in the development of the soil investigations.

The results of the sampling conducted through 2014 were included in the Human Health Risk Assessment (HHRA). Soil samples collected in the Outfall 007 drainage area were included in the HHRA for the Former Fueling Facility (DE-0266). Results of sampling conducted in the Outfall 002 drainage area are included in the HHRA for the Maintenance Facility (DE-0170). The results of the investigation conducted across the Facility through 2014 were presented in the IDS Report (refer to **Appendix 1-1**) and the sampling is summarized below.

<u>Surface Soil</u>

Surface soil sampling was conducted in unpaved areas and within tracks in order to characterize potentially erodible soils. Samples were collected from the upper six inches representing soil that could be mobilized to site drainage features through stormwater conveyance and overland flow during precipitation events. All samples were analyzed for PCB Aroclors with 20% of the samples collected in unpaved areas analyzed for target compound list/target analyte list (TCL/TAL) parameters. Samples collected in track areas were analyzed for PCB Aroclors with 10% of samples analyzed for TPH-DRO. The results of surface soil sampling through 2014 are included in the IDS Report (refer to **Appendix 1-1**).

<u>Subsurface Soil</u>

Soil borings were advanced during several mobilizations to characterize historical facility operations. Areas targeted for investigation included the former drum storage area, transformer locations, the location of the former TCE AST and degreasers, and other locations across the Facility. Soil samples were collected in two-foot intervals to the water table and all samples were analyzed for PCB Aroclors. At each soil boring an additional sample was collected for VOCs at the six-inch interval with the highest PID reading. If no VOCs were detected with the PID, a sample was collected from the six-inch interval above the water table. Samples were also collected for SVOCs, TAL-Metals, TPH-DRO, and TPH-GRO from the two-foot interval that included the interval where the VOC sample was collected. The results of the subsurface soil sampling through 2014 are included in the IDS Report (refer to **Appendix 1-1**).

Groundwater

Remedial investigations were performed through 2014 in order to characterize site groundwater and the occurrence of light non-aqueous phase liquid (LNAPL) and TCE across the Facility in accordance with the Revised RI/FFS Work Plan and Addendum. Groundwater investigations included monitoring well installation, depth to liquids measurements, groundwater sampling and slug testing. LNAPL sampling and laboratory analyses and LNAPL bail-down tests were also performed.

Groundwater monitoring well locations were placed in order to characterize LNAPL and TCE in groundwater as well as across the Facility to identify other constituents in groundwater. Groundwater was sampled for VOCs, SVOCs, PCBs (filtered and total), and TAL-Metals (filtered and total). Results of groundwater sampling through 2014 were summarized in the IDS Report (refer to **Appendix 1-1**).

Sediment

Sediment samples were collected in the Maintenance Facility drainage features in accordance with Revised WMF RI/FFS Work Plan and Addendum. The drainage features include the drainage swale between Outfall 002 and the Shellpot Creek (Outfall 002 Drainage Ditch) and the drainage ditch north of the Eastern Drainage Ditch (referred to as the Northeast Ditch or NED), located on the Norfolk Southern Property. The results of the sampling through 2014 were summarized in the IDS Report (refer to **Appendix 1-1**).

Samples were collected along two transects in the Outfall 002 drainage ditch and along the approximate centerline in one hundred-foot intervals in the NED. The sediment and soil samples were collected for laboratory analyses to evaluate the vertical profile. Representative sediment samples were retained for analysis from: (1) a depth of 0 to 3 inches (designated the "A" interval); (2) a depth of 3 inches to the top of the underlying clay substrate; (designated the "B" interval); (3) from the top the clay to one foot into the clay (designated the "C" interval). The "A" interval was analyzed to represent the potentially bioavailable/erodible layer. The "B" interval sample was analyzed to represent the bulk of sediment material at each location. The "B" horizon was subdivided into three-foot vertical intervals where applicable. The clay substrate ("C" interval) was not sampled since these samples are likely more reflective of the substrate rather than recent sedimentation.

All samples were analyzed for PCB Aroclors (USEPA Method 8082), TPH-DRO (Method 8015), and total organic carbon (TOC).

Sediment samples were also collected for additional laboratory analyses at each location in the A-interval and at eight locations in the B-interval of the NED. These additional samples were analyzed for VOCs, SVOCs, TAL-metals and TPH-GRO. Field measurements at each sediment sampling location included water depth, depth to sediment, thickness of sediment, and depth to clay substrate.

Surface Water

Surface water sampling was conducted as proposed in the RI/FFS Work Plan and Addendum. Wet weather and dry weather samples were collected at two locations in the NED. These samples were collected as grab samples. Dry weather samples were collected after a period of at least 72 hours with no precipitation. Wet weather sampling was conducted during a storm event of at least 0.1 inches in magnitude and at least one hour in duration.

Additionally, grab samples of water coming on to the Site (due to tidal back-flooding) were collected at one location in the NED as well as one location in the Outfall 002 Drainage Ditch.

Surface water samples from the Outfall 002 Drainage Ditch and the NED were analyzed for PCB Aroclors using USEPA Method 8082 (Lancaster Labs), PCB congeners using EPA Draft Test Method 1668A (Test America), and total suspended solids (unfiltered samples only) (Lancaster Labs). PCB analysis was performed on filtered and unfiltered samples. Samples were filtered by the laboratory. The surface water sampling and analytical results were summarized in the IDS Report.

Surface water sampling is also conducted at Outfall 002 in accordance with the NPDES Permit (DE0050962). Results of congener sampling at Outfall 002 are summarized in the PMP Annual Report for the Facility.

2015 IDS Report Supplemental Remedial Investigation Recommendations

Based on the results of the soil, sediment, groundwater, and surface water sampling, supplemental investigations were recommended to further characterize site media. Additional surface soil, subsurface soil, sediment, and groundwater sampling was recommended (refer to **Appendix 1-1**) and is summarized in Section 1.7 of this Report.

1.7 Supplemental Remedial Investigations

As described in the Revised RI/FFS Work Plan and Addendum, as well as the March 2015 IDS Report, the focus of the investigations was to characterize potentially erodible soil which may be a source of PCBs in storm water runoff from the Site as well as groundwater and sediment migration. Soil samples were also collected from paved areas, from select areas where past soil excavations were proposed (and soil removal documentation is not available) and from track areas. Surface soil and soil borings were collected for laboratory analyses.

The analytical results of samples collected and summarized in the IDS Report were used to target locations for additional characterization sampling. Soil sample collection and analytical results are summarized below. Groundwater samples were collected at monitoring wells installed at locations of historical operations in order to characterize potential impacts including LNAPL and chlorinated volatile organic compounds (cVOCs).

Sediment sampling was also conducted in site drainage ditches. Sampling data was evaluated against the DNREC- Site Investigation and Restoration Section (SIRS) Screening Levels, updated in November 2019.

The following discussion of the soil investigations is presented by investigation areas and only includes data not included in the IDS Report. Data from the Outfall 007 drainage area had previously been reported in the RSFFS for the Former Fueling Facility (DE-0266); however, where applicable, it is reported herein to present a more representative depiction of the proposed remedial investigations in the RSFFS and IDS Report.

1.7.1 Soil Investigations

Additional soil investigations were proposed in order to target areas reporting elevated constituent concentrations or to further characterize constituents in groundwater and soil described in the IDS Report. Soil sample locations are depicted on **Figure 1-12**. Soil sampling was targeted as described below:

- Three additional soil borings (LS-4 through LS-6) were proposed to characterize cVOCs in soil and groundwater in the area of the Locomotive Shop.
- Soil borings were advanced in order to determine the placement of planned injection wells for the Enhanced Reductive Dechlorination (ERD) for the treatment of cVOCs in the area of the Locomotive Shop and Administration Building.
- A degreaser that historically used TCE was also investigated on the east side of Building 16 (Material Control and Blacksmith Shop). Additional borings (designated SB-39A, SB-39B, SB-39C and SB-39D) and monitoring well NY-MW-36

were advanced to further characterize cVOC occurrence in the vicinity of SB-39 (which reported up to 48 mg/kg TCE in soil).

- Soil borings were also advanced at the locations of proposed monitoring wells (MW-25 through MW-55 at the WMF).
- Soil investigations related to infrastructure projects, including:
  - Building 15.1 Equipment Enclosure,
  - the Wreck Track Improvement Project (Operational Unit – 2 (OU-2) of DE-0170),
  - Roadway Storage Unit,
  - Aboveground Storage Tank (AST) Pad Project,
  - the National Railroad Transportation Center (NRTC) Project, and
  - Transfer Table Extension Project (OU-3 of DE-0170).

It should be noted that the Building 15.1 Equipment Enclosure, the Wreck Track Improvement Project and the Transfer Table Extension Project all have approved TSCA Self-Implementing Plans. DNREC-issued Final Plans of Remedial Action for the Wreck Track Improvement Project and Transfer Table Extension Project. The Building 15.1 Equipment Enclosure was completed as an Interim Action Plan under the VCP. All the above referenced infrastructure projects (including the Roadway Storage Unit, AST Pad Project, and NRTC Building) were investigated under the VCP. Additionally, Remediation Completion/Project Close-out Reports were submitted for the Building 15.1 Project and the Wreck Track Improvement Project upon completion of the infrastructure work. The Infrastructure Projects are depicted on **Figure 1-13**. The project-specific reports and correspondence are provided in **Appendix 1-1** and **1-2**. The Transfer Table Extension Project is in the planning phase and a Remediation Completion/Project Closeout Report will be submitted upon completion of the project.

1.7.1.1 Locomotive Shop Area Soil Borings

Three soil borings (LS-1, LS-2 and LS-3) were previously installed via GeoProbe inside the Locomotive Shop (Building 3) to the top of the clay layer which was encountered at approximately fifteen feet below ground surface (bgs) or refusal. The soil boring locations are depicted on **Figure 1-14**. Soil boring logs are provided as **Appendix 1-5**. Soil samples were collected from these locations in order to characterize the extent of impacts from cVOCs in soil around the former degreaser within the Locomotive Shop. Based on the results of these soil borings, three additional soil borings were advanced to further characterize soil in the Locomotive Shop. Soil borings LS-4, LS-5, and LS-6 were attempted during July 2015. Due to several layers of concrete, the GeoProbe was unable to advance beyond approximately one to one-and-a-half feet below the top of concrete. Soil samples were collected from between concrete layers during the July 2015 sampling event.

Soil borings LS-4, LS-5, and LS-6 were relocated within a few feet of the original soil boring locations and advanced to the top of the water table using a hand auger during March 2018. Each six-inch interval was placed in steel bowls and covered with aluminum foil. A photoionization detector (PID) was used to determine the presence of volatile organic compounds (VOCs) at each interval. Soil samples were collected from the six-inch interval with the highest PID reading as well as the six-inch interval above groundwater and analyzed for VOCs by EPA method 8260. After the VOC sample had been collected the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were collected for total petroleum hydrocarbons – diesel range organics (TPH-DRO), TPH-gasoline range organics (TPH-GRO), semi-volatile organic compounds (SVOCs) and target analyte list metals (TAL-metals) at LS-4, LS-5, and LS-6 in the two-foot interval that included the highest PID reading.

Additional soil borings LS-7 through LS 11 were installed to the west of the former TCE AST that was located between the Locomotive Shop and the Administration Building. These soil borings were installed in order to determine the extent of the planned pilot study for the injection of sodium lactate for enhanced reductive dechlorination (ERD). Soil boring locations are depicted on **Figure 1-12** and **Figure 1-14**.

VOC Results

Soil samples were collected and analyzed for VOCs. Analytical results are provided on **Table 1-1**. Analytical results for locations where TCE was detected above the DNREC-SIRS Screening Level for Soil are depicted on **Figure 1-15**. TCE was detected above the DNREC-SIRS Screening Level in soil of 0.41 mg/kg in nine of 19 samples collected ranging from 0.73 mg/kg at LS-6(2.5-3.0) to 19 mg/kg at LS-5(0.5-0.7) which is located between two concrete slabs.

No other VOC was detected above the DNREC-SIRS Screening Level for Soil in these soil borings. Laboratory analytical data reports for soil are provided in **Appendix 1-6**.

PCB Aroclor Results

At soil boring locations LS-4, LS-5, and LS-6, each two-foot interval was analyzed for PCBs by EPA method 8082. PCBs were reported above the DNREC-SIRS Screening Levels for PCBs at LS-5(0.5-0.7) at a concentration of 0.44 mg/kg during the July 2015 sampling event. PCBs results are provided in **Table 1-2**. **Figure 1-12** depicts the soil boring locations and **Figures 1-16a** through **1-16e** depict PCB Aroclor analytical results. Laboratory analytical data reports for soil are provided in **Appendix 1-6**.

SVOC Results

Soil samples were collected and analyzed for SVOCs at boring locations LS-4, LS-5, and LS-6 during the March 2018 sampling event. Samples were collected in the two-foot interval where the PID reading was highest. Where there were no VOCs detected, the sample was collected in the two-foot interval just above the water table.

There were no SVOCs detected above the method detection limits during the March 2018 sampling event at LS-4, LS-5, and LS-6. SVOC results are provided in **Table 1-3**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports for soil are provided in **Appendix 1-6**.

Metals Results

Soil samples were collected and analyzed for TAL-metals from soil borings LS-4, LS-5, and LS-6. Soil samples were collected in the two-foot interval where the PID reading was highest. Where there were no VOCs detected, the sample was collected in the two-foot interval just above the water table. TAL-metals results are provided on **Table 1-4**. Soil boring locations are provided on **Figure 1-12**.

Thallium was detected above the DNREC-SIRS Screening Level in soil of 0.078 mg/kg in all three soil borings where TAL-metals were analyzed. Concentrations of thallium ranged from 0.0879 mg/kg at LS-4(0.0-1.0) to 0.179 mg/kg at LS-5(2.0-4.0). No other TAL-metals were detected above the respective DNREC-SIRS Screening Level at LS-4, LS-5, or LS-6. Laboratory analytical data reports for soil are provided in **Appendix 1-6**.

TPH-DRO and TPH-GRO Results

Soil samples were collected and analyzed for TPH-DRO and TPH-GRO on one sample from each of the soil borings LS-4, LS-5, and LS-6. Soil samples were collected in the two-foot interval where the PID reading was highest. Where there were no VOCs detected, the sample was collected in the two-foot interval just above the water table. Concentrations of TPH-DRO and TPH-GRO were below the respective DNREC-SIRS Screening Levels for Soil. Soil analytical results are provided on **Table 1-2**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports for soil are provided in **Appendix 1-6**.

1.7.1.2 SB-39 Area Soil Borings

Soil boring SB-39 was installed in order to characterize soil down-gradient of a former degreaser located on the east side of Building 16 (Material Control and Blacksmith Shop). As was reported in the IDS Report, concentrations of TCE and cis-1,2-dichloroethene were detected in SB-39 at a depth of 4.0-4.5 ft. bgs at concentrations of 48 mg/kg and

21 mg/kg, respectively. As will be discussed later in this Report, a monitoring well (NY-MW-36) was installed at this location in 2015 to characterize groundwater adjacent to the former degreaser. Results of the soil sampling conducted during the installation of NY-MW-36 are included in this section as reference. Soil data related to the Outfall 007 drainage area, where the SB-39 area is located, was reported in the RSFFS for the Former Fueling Facility.

Soil borings SB-39A, SB-39B, SB-39C, and SB-39D were installed to the approximate north, south, east, and west of SB-39 in June 2015. Soil boring NY-MW-36 was installed at the approximate location of SB-39 in June 2015. The soil boring locations are depicted on **Figure 1-12**. Soil borings were advanced using a hand auger to the top of groundwater. The monitoring well located at NY-MW-36 was installed using a GeoProbe rig as will be described in Section 1.7.2. Soil boring logs are provided in **Appendix 1-5**. At each soil boring, each six-inch interval was placed in steel bowls and covered with aluminum foil. A photoionization detector (PID) was used to determine the presence of VOCs. Soil samples were collected from these soil borings from the six-inch intervals with the highest PID readings or the six-inch interval above groundwater. Soil samples were analyzed for VOCs by EPA method 8260. After the VOC sample had been collected, the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were also collected for TPH-DRO, TPH-GRO, SVOCs and TAL-metals from NY-MW-36 in the two-foot interval that included the highest PID reading. Soil analytical results are discussed below.

VOC Results

TCE was detected above the DNREC-SIRS Screening Level in Soil of 0.41 mg/kg at three of the seven soil samples ranging from 0.42 mg/kg at SB-39B(4.0-4.5) to 27 mg/kg at NY-MW-36(4.5-5.0) in the six-inch interval above groundwater. Analytical results are provided on **Table 1-5**. Soil boring locations are provided on **Figure 1-12**.

No other VOC was detected above the DNREC-SIRS Screening Level for Soil in these soil borings. Laboratory analytical data reports are provided in **Appendix 1-6**.

PCB Aroclor Results

Total PCBs were reported above the DNREC-SIRS Screening Levels for PCBs of 0.23 mg/kg at nine of the 14 soil samples collected ranging from 0.61 mg/kg at SB-39A(2.5-3.0) to 39 mg/kg at MW-36(2.0-4.0). PCBs results are provided in **Table 1-6**. **Figure 1-12** depicts the soil boring locations. PCB analytical results were included in the RSFFS for the Former Fueling Facility (DE-0266). Laboratory analytical data reports are provided in **Appendix 1-6**.

SVOC Results
A soil sample was collected and analyzed for SVOCs at soil boring location NY-MW-36(2.0-4.0) during the June 2015 sampling event. The sample was collected in the two-foot interval where the PID reading was highest.

Benzo(a)pyrene was detected above the DNREC-SIRS Screening Level for Soil of 0.09 mg/kg at a concentration of 0.24 mg/kg at NY-MW-36(2.0-4.0). SVOC results are provided in **Table 1-7**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports are provided in **Appendix 1-6**.

Metals Results
A soil sample was collected and analyzed for TAL-metals at soil boring location NY-MW-36(2.0-4.0) during the June 2015 sampling event. The sample was collected in the two-foot interval where the PID reading was highest.

Arsenic was detected above the DNREC-SIRS Screening Level for Soil of 11 mg/kg at a concentration of 14.9 mg/kg at NY-MW-36(2.0-4.0). TAL-metals results are provided in **Table 1-8**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports are provided in **Appendix 1-6**.

TPH-DRO and TPH-GRO
A soil sample was collected and analyzed for TPH-DRO and TPH-GRO at boring location NY-MW-36(2.0-4.0) during the June 2015 sampling event. The sample was collected in the two-foot interval where the PID reading was highest.

Neither TPH-DRO nor TPH-GRO were detected above the DNREC-SIRS Screening Level for Soil at NY-MW-36(2.0-4.0). TPH-DRO and TPH-GRO results are provided in **Table 1-6**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports are provided in **Appendix 1-6**.

1.7.1.3 NY-MW-1 Area Soil Investigation

As was reported in the IDS Report, on August 18, 2014 Stantec collected oil samples from monitoring wells NY-MW-1 and NY-MW-18. The samples were analyzed for PCBs in oil by EPA method 8082. There were no PCBs identified in NY-MW-18. Total PCB concentrations at NY-MW-1 were detected at a concentration of 540 mg/kg. The GC fingerprint analysis identified the product at NY-MW-18 most similar to mineral spirits (at approximately 34% by weight) and diesel/#2 fuel (at approximately 41% by weight). The monitoring well locations are depicted on **Figure 1-17**.

Additional oil samples were collected at NY-MW-1 on September 16, 2014. A grab oil sample was collected and analyzed for PCBs in oil and results indicated a concentration of total PCBs of 520 mg/kg. The product was then bailed off and allowed to recharge prior to collecting an additional grab sample. Total PCBs were identified at a concentration of 510 mg/kg.

In order to further characterize the extent of the LNAPL in the vicinity of NY-MW-1, additional monitoring wells NY-MW-25, NY-MW-40, and NY-MW-41 were installed. Monitoring well NY-MW-39 was attempted inside Building 13 (Metal Storage Building) however, subgrade obstructions were encountered, and the boring could not be advanced.

The monitoring wells were installed using hollow-stem auger (HSA) techniques. All wells were constructed of four-inch diameter PVC well materials. These wells were installed to the top of clay layer encountered between 13 ft. bgs and 16 ft. bgs. The well screens were set to the top of clay elevation. The tops of well screens were set several feet above observed groundwater occurrence during drilling. Well logs are provided as **Appendix 1-5**.

Soil borings were advanced using a hand auger to the top of groundwater. The monitoring wells (NY-MW-25, NY-MW-40, and NY-MW-41) were installed using a GeoProbe rig as will be described in Section 1.7.2. At each soil boring, each six-inch interval was placed in steel bowls and covered with aluminum foil. A PID was used to determine the presence of VOCs. Soil samples were collected from each six-inch interval with the highest PID readings and/or the six-inch interval above groundwater. Soil samples were analyzed for VOCs by EPA method 8260. After the VOC sample had been collected the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were also analyzed for TPH-DRO, TPH-GRO, SVOCs and TAL-metals in the two-foot interval that included the highest PID reading. Soil analytical results are discussed below. Laboratory analytical data reports are provided in **Appendix 1-6**.

<u>VOC Results</u>

There were no VOCs detected in any of the soil samples collected in the NY-MW-1 investigation area. Analytical results are provided on **Table 1-9**. Soil boring locations are provided on **Figure 1-12**.

<u>PCB Aroclor Results</u>

Total PCBs were reported above the DNREC-SIRS Screening Levels for PCBs of 0.23 mg/kg at two of the 10 soil samples collected ranging from 1.2 mg/kg at NY-MW-25(0.5-2.5) to 84 mg/kg at NY-MW-40(4.5-5.0). PCBs results are provided in **Table 1-10**. **Figure 1-12** depicts the soil boring locations. PCB analytical results are depicted on **Figure 1-16a** through **1-16e**.

SVOC Results

A soil sample was collected and analyzed for SVOCs at soil borings NY-MW-25, NY-MW-40, and NY-MW-41 during the 2015 sampling event. Samples were collected in the two-foot interval where the PID reading was highest or in the interval just above groundwater.

There were no SVOCs detected above the DNREC-SIRS Screening Level for Soil in any of the soil samples collected for the NY-MW-1 area investigation during 2015. SVOC results are provided in **Table 1-11**. Soil boring locations are provided on **Figure 1-12**.

Metals Results

A soil sample was collected and analyzed for TAL-metals at soil borings NY-MW-25, NY-MW-40, and NY-MW-41 during the 2015 sampling event. Samples were collected in the two-foot interval where the PID reading was highest or in the interval just above groundwater.

There were no metals detected above the DNREC-SIRS Screening Level for Soil in any of the soil samples collected for the NY-MW-1 area investigation during 2015. TAL-metals results are provided in **Table 1-12**. Soil boring locations are provided on **Figure 1-12**.

TPH-DRO and TPH-GRO

A soil sample was collected and analyzed for TPH-DRO and TPH-GRO at soil borings NY-MW-25, NY-MW-40, and NY-MW-41 during the 2015 sampling event. Samples were collected in the two-foot interval where the PID reading was highest or in the interval just above groundwater.

Neither TPH-DRO nor TPH-GRO were detected above their respective DNREC-SIRS Screening Level for Soil. TPH-DRO and TPH-GRO results are provided in **Table 1-11**. Soil boring locations are provided on **Figure 1-12**.

1.7.1.4 Administration Building Area Soil Investigation

CVOCs (including TCE) were identified in soil and groundwater in the area between the Locomotive Shop (Building 3) and the Administration Building (Building 12) as discussed in the IDS Report. Monitoring wells NY-MW-26 through NY-MW-39 (including replacement well NY-MW-33R) were installed to further characterize the extent of TCE in groundwater related to the former TCE AST and former degreaser depicted on **Figure 1-18**. Soil sampling was conducted at these locations prior to the installation of these wells. The soil sample locations are depicted on **Figure 1-12.** The monitoring well installation is discussed in greater detail in Section 1.7.2. As previously discussed, NY-MW-36 was installed in order to further characterize the SB-39 area and was summarized in Section 1.7.1.2. Soil analytical results associated with monitoring wells NY-MW-33, NY-MW-33R, NY-MW-34, NY-MW-36, NY-MW-37, and NY-MW-38 were summarized and addressed in the RSFFS Report for the Former Fueling Facility.

Soil borings were advanced using a hand auger to the top of groundwater. At each soil boring, each six-inch interval was placed in steel bowls and covered with aluminum foil. A PID was used to determine the presence of VOCs at each interval. Two soil samples were collected from each of these soil borings from the two six-inch intervals with the highest PID readings or the six-inch interval above groundwater. Each soil sample was analyzed for VOCs by EPA method 8260. After the VOC sample had been collected, the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were also collected for TPH-DRO, TPH-GRO, SVOCs and TAL-metals from the two-foot interval that included the highest PID reading. Soil analytical results are discussed below. At soil borings LS-7 through LS-11, only VOCs were analyzed. Soil analytical results for LS-1 through LS-11 were discussed in Section 1.7.1.1.

Soil sampling was also conducted during the installation of vapor depressurization points along the east wall of the Administration Building beneath the loading dock. These points were installed as an IRM to address the potential migration of vapors to the basement from subgrade soils. A discussion of the IRMs is provided in Section 1.8.

<u>VOC Results</u>

TCE was detected above the DNREC-SIRS Screening Level for Soil of 0.41 mg/kg at seven of the 27 samples collected at a concentration ranging from 1.0 mg/kg at NY-MW-30(0.0-0.5) to 34 mg/kg at NY-MW-31(0.0-0.5) collected just below the concrete inside the Locomotive Shop. Analytical results are provided on **Table 1-13**. Soil boring locations are provided on **Figure 1-12**. Analytical results for locations within the Outfall 002 drainage area where TCE was detected above the DNREC-SIRS Screening Levels are depicted on **Figure 1-15**.

No other VOC was detected above the DNREC-SIRS Screening Level for Soil in these soil borings. Laboratory analytical data reports are provided in **Appendix 1-6**.

<u>PCB Aroclor Results</u>

Total PCBs were reported above the DNREC-SIRS Screening Levels for Soil of 0.23 mg/kg at 21 of the 43 samples collected at concentrations ranging from 0.27 mg/kg at NY-MW-35(7.5-8.5) to 39 mg/kg at NY-MW-36(2.0-4.0). PCBs results are provided in **Table 1-14**. **Figure 1-12** depicts the soil boring locations. PCB analytical results are depicted on **Figure 1-16a** through **1-16e**. Laboratory analytical data reports are provided in **Appendix 1-6**.

SVOC Results

There were no SVOCs detected above the DNREC-SIRS Screening Levels for Soil in any of the 16 soil sample locations. SVOC results are summarized on **Table 1-15**. **Figure 1-12** depicts the soil boring locations. Laboratory analytical data reports are provided in **Appendix 1-6**.

TAL-Metals Results

TAL-Metals were detected above the DNREC-SIRS Screening Levels for Soil in one or more soil sample. TAL-Metals results are summarized below:

Antimony was detected above the DNREC-SIRS Screening Level for Soil of 3.1 mg/kg in five of the 16 samples ranging from 4.46 mg/kg at NY-MW-27(0.6-2.0) to 9.41 mg/kg NY-MW-36(2.0-4.0).

Arsenic was detected above the DNREC-SIRS Screening Level for Soil of 11 mg/kg in three of the 16 samples ranging from 12.1 mg/kg at NY-MW-35(7.5-8.5) to 15.4 mg/kg at NY-MW-35(6.0-7.5).

Cadmium was detected above the DNREC-SIRS Screening Level for Soil of 7.1 mg/kg in NY-MW-35(7.5-8.5) at a concentration of 7.73 mg/kg.

Lead was detected above the DNREC-SIRS Screening Level for Soil of 400 mg/kg in two of the 16 samples collected at a concentration of 786 mg/kg at NY-MW-35(7.5-8.5) and 926 mg/kg at NY-MW-35(6.0-7.5).

Thallium was detected above the DNREC-SIRS Screening Level for Soil of 0.078 mg/kg in three of the 16 samples collected at concentrations ranging from 0.122 mg/kg at NY-MW-33R(4.0-5.5) to 9.81 mg/kg at NY-MW-39(0.7-1.0).

Zinc was detected above the DNREC-SIRS Screening Level for Soil of 2,300 mg/kg in NY-MW-35(7.5-8.5) at a concentration of 7,830 mg/kg.

TAL-metals results are provided in **Table 1-16**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports are provided in **Appendix 1-6**.

TPH-DRO and TPH-GRO

Neither TPH-DRO nor TPH-GRO were detected above the DNREC-SIRS Screening Level for Soil. TPH-DRO and TPH-GRO results are provided in **Table 1-15**. Soil boring locations are provided on **Figure 1-12**. Laboratory analytical data reports are provided in **Appendix 1-6**.

1.7.1.5 Monitoring Well NY-MW-42 Soil Investigation

Monitoring well NY-MW-42 was installed in order to characterize TPH-DRO identified at SB-45 as well as to characterize chlorobenzene identified at NY-MW-8. This soil boring was advanced to the top of the groundwater surface using a hand auger. After the soil samples were collected, the monitoring well was installed as will be described in Section 1.7.2.

This soil boring was installed in the Outfall 007 drainage area and soil analytical results were provided in the RSFFS for the Former Fueling Facility (DE-0266). Groundwater analytical results for this monitoring well are provided in Section 1.7.2.

1.7.1.6 Monitoring Well NY-MW-45 through NY-MW-48 Soil Investigation

Monitoring wells NY-MW-45 through NY-MW-48 were installed in order to characterize LNAPL identified in the vicinity of the Wheel Shop (Building 37) and Material Control Building (Building 16). The soil borings were advanced to the top of the groundwater surface using a hand auger. After the soil samples were collected, the monitoring wells were installed as will be described in Section 1.7.2. No monitoring well was installed at NY-MW-47 due to the presence of subsurface utilities.

These soil borings were installed in the Outfall 007 drainage area and soil analytical data was provided in the RSFFS for the Former Fueling Facility (DE-0266). Groundwater analytical results for these monitoring wells are provided in Section 1.7.2.

1.7.1.7 Locomotive Yard LNAPL Investigation

Monitoring wells NY-MW-51 through NY-MW-55 were installed in order to characterize LNAPL identified in the Locomotive Yard during the Locomotive Tracks 1, 2, and 3 Project (OU-4 of DE-0266). The soil borings were advanced to the top of the groundwater surface using a hand auger. After the soil samples were collected, the monitoring wells were installed as will be described in Section 1.7.2. The soil boring locations are depicted on **Figure 1-12**.

Each six-inch interval was placed in steel bowls and covered with aluminum foil. A PID was used to determine the presence of VOCs at each interval. A soil sample was collected from the soil boring from the six-inch interval above groundwater and analyzed for VOCs by EPA method 8260. After the VOC sample had been collected the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were also analyzed for TPH-DRO, TPH-GRO, SVOCs and TAL-metals in the two-foot interval that included the highest PID reading. Soil analytical results are discussed below.

Soil analytical results associated with these soil borings were incorporated in the upland soil remedy for the Former Fueling Facility (DE-0266) as described in the RSFFS and Addendums but are presented here to provide an assessment of LNAPL in this area. Laboratory analytical data reports are provided in **Appendix 1-6**.

VOC Results

No VOCs were detected above the DNREC-SIRS Screening Levels for Soil in any of the soil samples collected at NY-MW-51 through NY-MW-55. Analytical results are provided on **Table 1-17**. Soil boring locations are provided on **Figure 1-12**.

PCB Aroclor Results

Analytical results reported seven out of nine soil samples detected concentrations above the DNREC-SIRS Screening Levels for total PCB Aroclors of 0.23 mg/kg at concentrations ranging from 0.44 mg/kg at NY-MW-51(2.0-4.0) to 38 mg/kg at NY-MW-51(0.0-2.0). PCB results are provided in **Table 1-18**. Soil boring locations are provided on **Figure 1-12**.

SVOC Results

There were no SVOCs detected above the DNREC-SIRS Screening Levels for Soil at NY-MW-51 through NY-MW-55. SVOC results are provided in **Table 1-19**. Soil boring locations are provided on **Figure 1-12**.

Metals Results

Soil samples were collected for TAL-metals and analyzed by method 6020. Arsenic was identified above the DNREC-SIRS Screening Level for Soil of mg/kg of 11 mg/kg at a concentration of 20.4 mg/kg in NY-MW-54(0.0-2.0). Thallium was detected above the DNREC-SIRS Screening Level for Soil of 0.078 mg/kg in NY-MW-53(0.0-2.0) at a concentration of 0.439 mg/kg and NY-MW-54(0.0-2.0) at a concentration of 0.536 mg/kg.

No other TAL-metal was detected above a DNREC-SIRS Screening Level for Soil in soil borings NY-MW-51 through NY-MW-55. TAL-metals results are provided in **Table 1-20**. Soil boring locations are provided on **Figure 1-12**.

TPH-DRO and TPH-GRO

TPH-DRO was detected above the DNREC-SIRS Screening Level for Soil of 1,000 mg/kg in NY-MW-52(2.0-2.5) at a concentration of 6,900 mg/kg. TPH-GRO was not detected above the DNREC-SIRS Screening Level for Soil in soil borings NY-MW-51 through NY-MW-55. TPH-DRO and TPH-GRO results are provided in **Table 1-18**. Soil boring locations are provided on **Figure 1-12**.

1.7.1.8 Replacement Well Soil Boring Results

Monitoring well NY-MW-9 was abandoned on January 26, 2016 in preparation for the construction of the planned ACS-64 Test/Warranty Building (Operable Unit (OU-1) of DE-0266). The Well Abandonment Report is provided in **Appendix 1-5**. This project was summarized in the Remediation Completion/Project Closeout Report submitted to DNREC on April 23, 2018 and completed in accordance with the *Notification and Certification of Self-Implementing Cleanup and Disposal of PCB Remediation Waste – ACS-64 Test/Warranty Building* dated July 2, 2014 and DNREC's *Final Plan of Remedial Action* (OU-1 of DE-0266), dated June 6, 2014. Replacement monitoring well NY-MW-9R was installed February 2018.

In preparation for the construction of the planned Transfer Table Extension Project (OU-3 of DE-0170), monitoring well NY-MW-11 was abandoned on June 16, 2017. The Well Abandonment Report is provided in **Appendix 1-5**. The Transfer Table Extension Project has not been implemented at the time of this Report. Analytical data has been reported related to this project in the *Remedial Investigation Report – Transfer Table Extension Soil Characterization* was submitted to DNREC on August 15, 2017 and the *Notification and Certification of Self-Implementing Cleanup and Disposal of PCB Remediation Waste – Transfer Table Extension Project*. Replacement monitoring well NY-MW-11R was installed in February 2018.

Additionally, NY-MW-33R was installed March 19, 2018 in order to verify the depth to clay in the area adjacent to NY-MW-33. The soil boring log for NY-MW-33 was advanced to a depth of 25 ft. where running sands precluded further advancement of the augers and did not identify clay at the base of the soil boring. NY-MW-33 was advanced to a depth of 24 ft. bgs. Clay was identified at a depth of 22 ft. bgs. Because NY-MW-33 did not fully penetrate the clay layer, the well will not be abandoned. Replacement monitoring well NY-MW-33R was installed in March 2018. Soil analytical data related to NY-MW-33R was discussed in Section 1.7.1.4.

At each of these locations, the soil borings were advanced to the top of the groundwater surface using a hand auger. After the soil samples were collected, the monitoring wells were installed as will be described in Section 1.7.2. Each six-inch interval was placed in steel bowls and covered with aluminum foil. A PID was used to determine the presence of VOCs at each interval. A soil sample was collected from the interval with the highest PID reading or the six-inch interval above groundwater and analyzed for VOCs by EPA method 8260. After the VOC sample had been collected the soil was composited in two-foot intervals and samples were collected and analyzed for PCBs by EPA method 8082. Samples were also collected for TPH-DRO, TPH-GRO, SVOCs and TAL-metals in the two-foot interval that included the VOC sample interval. Soil analytical results are discussed below. Laboratory analytical data reports are provided in **Appendix 1-6**.

These soil borings were installed in the Outfall 007 drainage area. The soil data related to these soil borings were incorporated in the upland soil remedy as described in the Former Fueling Facility RSFFS and Addendums (DE-0266).

VOC Results

No VOCs were detected above the DNREC-SIRS Screening Levels for Soil in any of the soil samples collected at NY-MW-9R, NY-MW-11R, or NY-MW-33R. Analytical results are provided on **Table 1-21**. Soil boring locations are provided on **Figure 1-12**.

PCB Aroclor Results

Analytical results reported no PCB Aroclors in soil boring location NY-MW-9R. Concentrations of total PCB Aroclors in NY-MW-11R and NY-MW-33R were detected above the DNREC-SIRS Screening Levels of 0.23 mg/kg at concentrations ranging from 1.4 mg/kg at NY-MW-11R(4.0-5.0) to 26 mg/kg at NY-MW-11R(0.0-2.0). PCBs results are provided in **Table 1-22**. **Figure 1-12** depicts the soil boring locations.

SVOC Results

There were no SVOCs detected above the DNREC-SIRS Screening Levels for Soil in soil borings NY-MW-9R, NY-MW-11R or NY-MW-33R. SVOC results are provided in **Table 1-23**. Soil boring locations are provided on **Figure 1-12**.

Metals Results

Soil samples were collected for TAL-metals and analyzed by method 6020. TAL-metals were detected above the DNREC-SIRS Screening Level for Soil in one or more soil sample.

Antimony was identified above the DNREC-SIRS Screening Level for Soil of 3.1 mg/kg at a concentration of 8.46 mg/kg in NY-MW-9R(2.0-3.5).

Thallium was detected above the DNREC-SIRS Screening Level for Soil of 0.078 mg/kg at concentrations ranging from 0.0947 mg/kg at NY-MW-9R(2.0-3.5) to 0.122 mg/kg at NY-MW-33R(4.0-5.5).

No other TAL-metal was detected above a DNREC-SIRS Screening Level for Soil in borings NY-MW-9R, NY-MW-11R or NY-MW-33R. TAL-metals results are provided in **Table 1-24**. Soil boring locations are provided on **Figure 1-12**.

TPH-DRO and TPH-GRO

TPH-DRO and TPH-GRO were not detected above the DNREC-SIRS Screening Levels for Soil at NY-MW-9R, NY-MW-11R, or NY-MW-33R. TPH-DRO and TPH-GRO results are provided in **Table 1-22**. Soil boring locations are provided on **Figure 1-12.**

1.7.1.9 Pit 16 and 17 Investigation

The IDS Report discussed results of the Industrial Waste Sewer track back investigation. During this investigation, sediment samples were collected from manhole locations in order to determine the source of elevated PCB concentrations in sludge in the onsite wastewater treatment facility (Building 23). The highest concentrations of PCBs were identified in the manholes outside Building 7. The trackback investigation was summarized in the IDS Report. PCBs in oil samples were collected from inside Pit 16 and Pit 17 and are discussed further in Section 1.7.2.

In January 2017, in order to characterize the presence of LNAPL in the area of Pit 16 and Pit 17, several soil borings were advanced in the vicinity of Pit 16 and Pit 17 as well as manhole IW-MH-5 outside the roll-up door to Track 17. These soil borings were installed in order to characterize the periodic occurrence of LNAPL in the Building 7 (High Bay) Pits 16 and 17. Five soil borings were advanced outside Building 7. Two locations were attempted within Building 7; however, the concrete slab inside the building was too thick and the coring machine was unable to penetrate to the subgrade soil. Soil boring locations are depicted on **Figure 1-12**. The Pit #16 and #17 investigation area is depicted on **Figure 1-19**.

The soil borings P17-1 through P17-4 were advanced to groundwater using a hand auger. Groundwater was encountered at a depth of 4.7 ft. at P17-1 through P17-4. Soil boring P17-5 was advanced to two and a half feet below ground surface where auger refusal was encountered. Soil samples were collected from each two-foot interval and analyzed for PCBs by method 8082. Additionally, soil samples were collected from the three-inch interval above the groundwater interface and analyzed for TPH-DRO and TPH-GRO. Soil boring logs are provided in **Appendix 1-5**.

Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg in 15 of 16 samples collected at concentrations ranging from 0.51 mg/kg at P17-5(0-2) to 42 mg/kg at P17-1(0-2). TPH-DRO and TPH-GRO were not detected above the method detection limits in any of the samples collected. The analytical data is provided as **Table 1-25**. The soil boring locations are depicted on **Figure 1-12**.

There were no monitoring wells installed during this event due to a lack of PID readings as well as no detections of TPH-DRO or TPH-GRO.

Two standpipes were installed in Pit 16 and three standpipes were installed in Pit 17. Both pits are four feet in depth from the top of rail to the top of concrete inside the pit. The concrete at the bottom of the pits ranged from 11 inches to 14 inches thick. Subgrade material consisted of mottled clayey fine sand. Due to the amount of clay in the soil, there was no evidence of groundwater. The standpipes were installed to depths ranging from 2.4 ft. below top of concrete (6.4 ft. from surface outside of the pit) at Pit 16-N (refusal on concrete) to 3.9 ft. below top of concrete (7.9 ft. from surface outside of the pit) at Pit 17-M. The standpipe locations are depicted on **Figure 1-19**.

Soil samples were collected from each of the standpipe locations and analyzed for PCBs by method 8082. Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg at all five sample locations at concentrations ranging from 0.28 mg/kg in Pit-16-N(1.5-2.0) to 1.36 mg/kg in Pit-17S(0.9-1.4). There were no PID readings or stained soil observed in any of the standpipe locations. Soil analytical results are provided on **Table 1-25**.

Monitoring wells NY-MW-56 and NY-MW-57 were installed to the south and the west of Building 7 in order to further characterize the extent of LNAPL identified in Pits 16 and 17. Soil sampling was conducted in six-inch intervals to the top of the water table using a hand auger. Each interval was screened using a PID and a soil sample was collected from the interval with the highest PID reading and analyzed for VOCs. If there were no PID readings a sample was collected from the six-inch interval above the water table. Once the VOC sample was collected, the soil was composited in two-foot intervals and sampled for PCBs. The two-foot interval including the interval where VOCs were sampled was also analyzed for SVOCs, TAL-Metals, TPH-DRO and TPH-GRO.

<u>VOCs</u>

No VOCs were detected above the DNREC-SIRS Screening Levels for Soil in any of the samples collected. The results of the VOC analyses are presented on **Table 1-26**. Soil boring locations are depicted on **Figure 1-25.**

<u>PCBs</u>

Four samples were collected for PCB Aroclors analysis as a part of the initial investigation. Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg in three of the four soil samples collected ranging from a concentration of 0.51 mg/kg in NY-MW-56(2.0-4.0) to 14 mg/kg in NY-MW-56(0.0-2.0). The results of the PCB analyses are presented on **Table 1-25.** Soil boring locations are depicted on **Figure 1-25**.

<u>SVOCs</u>

There were no SVOCs identified above the DNREC-SIRS Screening Level for Soil in either location. The results of the SVOC analyses are presented on **Table 1-27**. Soil boring locations are depicted on **Figure 1-27.**

TAL-Metals

There were no TAL-metals detected above the DNREC-SIRS Screening Levels for Soil. TAL-metals results are summarized on **Table 1-28**. Soil boring locations are depicted on **Figure 1-25**.

TPH DRO and GRO

Neither TPH-DRO nor TPH-GRO were detected above their respective DNREC-SIRS Screening Level for Soil. The results of the TPH-DRO and TPH-GRO analyses are also presented on **Table 1-25.** Soil boring locations are depicted on **Figure 1-25**.

1.7.1.10 Infrastructure Projects Soil Investigations

Several infrastructure projects have been implemented at the Facility since the submittal of the IDS Report. The infrastructure project locations are depicted on **Figure 1-13**. Because the Outfall 007 drainage area soils were included in the RSFFS for the Former Fueling Facility (DE-0266), the ACS-64 Test/Warranty Center (OU-1 of DE-0266), Car Shop Relocation Building (OU-2 of DE-0266), and Locomotive Tracks 1, 2, and 3 Improvement Projects (OU-4 of DE-0266) soil investigations were summarized in the RSFFS Report and residual soil concentrations will be addressed as part of the Remedial Action for the Former Fueling Facility.

In addition to these projects, the Building 15.1 Equipment Enclosure (within DE-0170) and Wreck Track Improvement Project (OU-2 of DE-0170) were completed in accordance with approved TSCA Self-Implementing Plans. Remediation Completion/Project Close-out Reports were submitted for these projects and are provided in **Appendix 1-1**. The post-excavation soil sample results collected outside the footprint (sidewall samples) of these projects are discussed below.

The Notification and Certification of Self-Implementing Clean-up and Disposal of PCB Remediation Waste – Transfer Table Extension (OU-3 of DE-0170) was submitted on August 16, 2017 and approved by the EPA in a letter dated September 8, 2017. The Remedial Investigation Report – Transfer Table Extension Soil Characterization was submitted to DNREC on August 15, 2017. A Final Plan of Remedial Action was issued by DNREC on December 31, 2017. This project has not been implemented to date. Soil characterization results related to the RIR for the Transfer Table Extension Project are provided below.

Three additional investigations were conducted as part of infrastructure improvement projects. Remedial Investigation Work Plans were submitted for these projects to outline the planned investigations. These projects include:

- AST Pad Project
- NRTC Building Project
- Roadway Storage Unit

All three of the above projects have been completed. TSCA Self-Implementing Plans were not completed for these projects since the work is being conducted as "performance-based" under 40 CFR 761.61(b). Soil sampling was completed for these projects in accordance with the VCP. The details of the soil characterization and engineering and institutional controls are described in further detail below.

1.7.1.10.1 Wreck Track Improvement Project

The Wreck Track Improvement Project (OU-2 of DE-0170) was implemented according to the *Notification and Certification of Self-Implementing Clean-up and Disposal of Remediation Waste – Wreck Track Improvement Project* (Wreck Track Notification). Post-excavation soil sampling was conducted at the base of the excavation as well as the sidewalls in five-foot linear intervals and analyzed for PCB Aroclors by EPA method 8082. Within the footprint of the Wreck Track Improvement Project, soil was excavated to a depth where PCB concentrations were identified below the cleanup goal for this project under the Wreck Track Notification.

Concentrations of PCB Aroclors identified in post-excavation side-wall samples were reported in the Remediation Completion/Project Close-out Report and are included in this RI and results are provided below. Other constituents including VOCs, SVOCs, TAL-metals, TPH-DRO, and TPH-GRO were addressed according to the Final Plan of Remedial Action dated August 26, 2016.

<u>PCB Aroclors</u>

There were 224 soil samples collected from the sidewalls of the Wreck Track excavation footprint. Of the 224 soil samples collected, 212 detected total PCB Aroclor concentrations above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg at concentrations ranging from 0.24 mg/kg at W-91W to 130 mg/kg at W-39W. The PCB results are provided as **Table 1-29**. The soil sample locations and bottom post-excavation results are depicted on **Figure 1-20**.

1.7.1.10.2 Building 15.1 Equipment Enclosure Project

The Building 15.1 Equipment Enclosure Project was implemented in accordance with the *Notification and Certification of Clean-up and Disposal of PCB Remediation Waste – Building 15.1 Equipment Enclosure* (Building 15.1 Notification) dated March 2016 and Amendment May 16, 2016 (**Appendix 1-1** and **1-2**). The location of the Building 15.1

Equipment Enclosure Project is depicted on **Figure 1-13**. Post-excavation soil sampling was conducted at the base of the excavation in a five-foot grid as well as the sidewalls in five-foot linear intervals and analyzed for PCB Aroclors by EPA method 8082. Within the footprint of the Building 15.1 Equipment Enclosure Project, soil was excavated to a depth where PCB concentrations were identified below the cleanup goal for this project under the Building 15.1 Notification. Laboratory analytical data reports are provided in **Appendix 1-6**.

Concentrations of PCB Aroclors identified in post-excavation side-wall samples were reported in the Remediation Completion/Project Close-out Report and are provided below. Other constituents were not investigated as part of this project in accordance with the Interim Action Plan submitted to DNREC on December 7, 2015 (**Appendix 1-1**).

<u>PCB Aroclors</u>

There were 20 soil samples collected from the sidewalls of the Building 15.1 Equipment Enclosure excavation footprint. Total PCB Aroclor concentrations were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg at a concentration of 2.0 mg/kg at B15.1-13S. The PCB results are provided as **Table 1-30**. The soil sample locations are depicted on **Figure 1-21**.

1.7.1.10.3 Transfer Table Extension Project

A *Notification and Certification of Self-Implementing Clean-up and Disposal of Remediation Waste – Transfer Table Extension Project* (Transfer Table Notification) was submitted to EPA on August 16, 2017. The Notification was approved September 8, 2017 (**Appendix 1-1** and **1-2**). The Remedial Investigation Report – Transfer Table Extension Soil Characterization, dated August 15, 2017 was submitted to DNREC and a Final Plan of Remedial Action was issued on December 31, 2017 (**Appendix 1-1** and **1-2**). This project has yet to be implemented.

As described in the Notification, as currently configured, the Transfer Table Extension Project area is located within the Outfall 007 drainage area. When the project is completed, the footprint of the project will drain to the Outfall 002 drainage area and was described as OU-3 of DE-0170. Soil excavation will be completed in accordance with the Transfer Table Notification.

Soil samples were collected for the purposes of the DNREC VCP remedial investigation. On June 16, 2017 and June 20, 2017 eight soil borings (TT-OU-1 through TT-OU-8) were advanced to the top of the water table using direct push methodology via Geoprobe. Soil samples were collected below the surface asphalt layer to the water table as described below. The water table was encountered at a depth ranging from 4.5 ft. bgs (TT-OU-4) to 8.0 ft. bgs (TT-OU-8). Soil boring logs are presented in **Appendix 1-5**.

Soil samples were collected and analyzed for VOCs (EPA method 8260B), SVOCs (EPA method 8270C), TPH-DRO and TPH-GRO (EPA method 8015), PCBs (EPA method 8082), and TAL metals (EPA method 6010 & 7471B). PCB samples were collected in two-foot intervals to the top of the water table. Every six-inch interval was isolated, and field screened utilizing a PID. VOC samples were collected from the six-inch interval representing the highest PID reading or the six-inch interval above the water table. SVOC, TPH-DRO, TPH-GRO, and TAL-Metals samples were collected from the two-foot interval that included the VOC sample. Samples collected for PCBs were extracted by Eurofins Lancaster Labs (a DNREC HSCA/VCP certified lab) using EPA method 3550B according to 40 CFR 761.272. Laboratory analytical data reports are included in **Appendix 1-6**.

VOCs

No VOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the VOC analyses are presented on **Table 1-31**. Soil boring locations are depicted on **Figure 1-22.**

PCBs

Of the 26 samples collected for PCB Aroclors, six samples exceeded the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg for total PCBs at concentrations ranging from 0.82 mg/kg at TT-OU-5(0.0-2.0) to 45 mg/kg at TT-OU-3(0.0-2.0). The results of the PCB analyses are presented on **Table 1-32.** Soil boring locations are depicted on **Figure 1-22**.

Characterization samples for PCBs related to the Transfer Table Extension Project were reported in the Transfer Table Notification and represent soil that will be excavated during construction.

SVOCs

No SVOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the SVOC analyses are presented on **Table 1-33**. Soil boring locations are depicted on **Figure 1-22**.

TAL-Metals

Only lead was detected above the DNREC-SIRS Screening Levels for Soil of 400 mg/kg in sample TT-OU-2(4.0-5.0) at a concentration of 497 mg/kg. The results of the TAL-Metals analyses are presented on **Table 1-34**. Soil boring locations are depicted on **Figure 1-22**.

TPH DRO and GRO

No TPH-DRO or TPH-GRO samples were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the TPH-DRO and TPH-GRO analyses are also presented on **Table 1-33.** Soil boring locations are depicted on **Figure 1-22**.

Additional soil analytical results were reported for PCBs in the Transfer Table Extension Notification. As previously mentioned, this project has yet to be implemented. Soil within the footprint of this project will be addressed in accordance with the Transfer Table Extension Notification.

1.7.1.10.4 AST Pad Project

The AST Pad Project consisted of installing a concrete pad over an approximate 750 sq. ft. area east of Building 7. Details of the AST Pad Project were provided to DNREC in an email correspondence dated October 23, 2017. DNREC approved of the investigation work plan on November 2, 2017. The location of the AST Pad Project is depicted on **Figure 1-23**.

As described in the October 23, 2017 correspondence, the following investigation was conducted. One soil boring was advanced within the footprint of the proposed AST Pad. Representative samples were collected to the top of groundwater in order to characterize the soil within the planned AST pad project footprint. Three soil borings were advanced at the perimeter to the north, east and south, outside the footprint of the planned excavation. These soil borings characterized soil to remain outside the planned project. At each of these soil boring locations, representative samples were collected from just below asphalt to the top of the water table. No samples were collected to the west of the planned AST Pad Project because of the proximity to the outside eastern wall of Building 7. Soil boring locations are depicted on **Figure 1-23**.

At each location soil samples were collected in six-inch intervals and screened with a PID. The six-inch interval with the highest PID reading was analyzed for VOCs. If no PID readings were identified in the soil boring, the six-inch interval above the water table was analyzed for VOCs. The two-foot interval that includes the VOC sample was also analyzed for SVOCs, TAL-metals, TPH-DRO, and TPH-GRO. Each two-foot interval to the top of the water table was analyzed for PCBs. Sample analyses were performed by Eurofins Lancaster Laboratories (a DNREC HSCA/VCP certified lab). Based on previous correspondence with EPA and DNREC, the laboratory extraction was conducted using USEPA method 3550B (sonication). Laboratory analytical data reports are included in **Appendix 1-6**.

<u>VOCs</u>

No VOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the VOC analyses are presented on **Table 1-35**. Soil boring locations are depicted on **Figure 1-23.**

PCBs

Of the 13 samples collected for PCB Aroclors, four samples exceeded the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg for total PCBs at concentrations ranging from 0.40 mg/kg at AST-OU-1(6.0-6.5) to 3.5 mg/kg at AST-OU-1(0-2). The results of the PCB analyses are presented on **Table 1-36.** Soil boring locations are depicted on **Figure 1-23**. PCB Aroclor results are depicted on **Figures 1-16a** through **1-16e**.

SVOCs

No SVOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the SVOC analyses are presented on **Table 1-37**. Soil boring locations are depicted on **Figure 1-23**.

TAL-Metals

None of the TAL-metals were detected above the DNREC-SIRS Screening Levels for in any of the samples collected. The results of the TAL-metals analyses are presented on **Table 1-38**. Soil boring locations are depicted on **Figure 1-23**.

TPH DRO and GRO

TPH-DRO was detected above the DNREC-SIRS Screening Level for Soil of 1,000 mg/kg in soil borings AST-OU-1(6-6.5) at a concentration of 8,800 mg/kg and AST-OU-4(4-6) at a concentration of 2,000 mg/kg. TPH-GRO was not detected at concentrations above the DNREC-SIRS Screening Level for Soil of 100 mg/kg. The results of the TPH-DRO and TPH-GRO analyses are also presented on **Table 1-36.** Soil boring locations are depicted on **Figure 1-23**.

AST Pad Post-Excavation PCB Aroclor Verification Sampling

The AST Pad Project was initiated in June 2019. Soil excavation was conducted to planned depths for the placement of the concrete slab. Excavated soil was disposed at a TSCA-licensed Facility (US Ecology in Bellevue, Michigan). At the bottom and sidewalls of the excavation, soil samples were collected in a five-foot grid pattern in accordance with 40 CFR 761 Subpart O. Soil samples were collected and analyzed for PCB Aroclors by EPA method 8082 using extraction method 3550 (sonication) by Eurofins Lancaster Laboratories.

Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg at 61 of the 76 sample locations ranging from 0.24 mg/kg at F-5E to 18 mg/kg at C-1(2.5-2.8). Soil analytical results are summarized on **Table 1-39**. Soil sample locations are depicted on **Figure 1-23**. Laboratory analytical data reports are provided in **Appendix 1-6**.

Upon receipt of the laboratory analytical results, the AST Pad Project footprint was completed with a greater than six-inch reinforced concrete slab prior to placement of the ASTs.

1.7.1.10.5 Roadway Storage Unit (RSU) Project

Details of the Roadway Storage Unit Project were provided to DNREC in an email correspondence dated October 24, 2017. DNREC approved of the investigation work plan on November 2, 2017 (**Appendix 1-1** and **1-2**). The Roadway Storage Unit Project consists of an area approximately 1,500 square feet (sq. ft.) at the northwestern portion of the Wilmington Maintenance Facility. The building location is depicted on **Figure 1-13**. The project was implemented to provide additional storage space for the Roadway Department.

As described in the October 24, 2017 correspondence, the following investigation was conducted. One soil boring was advanced within the footprint of the Roadway Storage Unit. Representative samples were collected to the top of groundwater in order to characterize the soil within the planned footprint. Four soil borings were advanced at the perimeter to the north, south, east and west, outside the footprint of the planned structure. These soil borings were used to characterize soil outside the planned project footprint. At each of these soil boring locations, representative samples were collected from just below asphalt and subbase stone to the top of the water table. Soil sample locations are depicted on **Figure 1-24**.

At each location soil samples were collected in six-inch intervals and screened with a PID. The six-inch interval with the highest PID reading was analyzed for VOCs. If no PID readings were identified in the soil boring, the six-inch interval above the water table was analyzed for VOCs. The two-foot interval that includes the VOC sample was also analyzed for SVOCs, TAL-metals, TPH-DRO, and TPH-GRO. Each two-foot interval to the top of the water table was analyzed for PCBs. Sample analyses were performed by Eurofins Lancaster Laboratories (a DNREC HSCA/VCP certified lab). Based on previous correspondence with EPA and DNREC, the laboratory extraction was conducted using EPA method 3550B (sonication),

In addition, Amtrak performed soil sampling activities in a 10 foot (ft.) by 10 ft. grid within the storage unit footprint. Soil samples were collected from the 3-inch interval beneath the existing sub-base stone and were analyzed for PCB Aroclors by EPA method 8082 using EPA method 3550B (sonication).

There was no excavation associated with this project based on soil analytical results. Prior to placement of the building which consisted of a shed-like structure, anchored to asphalt, asphalt was placed on existing asphalt up to 16 inches in thickness (but not less than six inches thick) to provide a level surface to place the building.

The project was implemented in accordance with TSCA 40 CFR 761.61(b). A summary of the soil sampling results is provided below. Laboratory analytical data reports are included in **Appendix 1-6**.

VOCs

No VOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the VOC analyses are presented on **Table 1-40**. Soil boring locations are depicted on **Figure 1-24.**

PCBs

A total of 37 samples were collected for PCB Aroclors analysis as a part of this investigation. Samples were collected for the RI work plan submitted on October 24, 2018 and in a grid pattern just under the subbase stone in the footprint of the building. Soil borings RSU-OU-1 through RSU-OU-4 were advanced to the west, south, east and north of the building footprint, respectively. Soil boring RSU-OU-5 and the grid samples were collected within the footprint of the building. Soil sample locations are depicted on **Figure 1-24**.

Samples collected outside the footprint of the building identified total PCB Aroclors above the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg in all eleven soil samples collected ranging from a concentration of 0.34 mg/kg at RSU-OU-4-3(4.0-5.5) to 15 mg/kg at RSU-OU-4-2(0.0-2.0). Soil samples collected within the footprint of the building identified total PCB Aroclors above the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg at concentrations ranging from 0.29 mg/kg (RSU-C-1(0.8-1.0)) to 44 mg/kg (RSU-OU-4-5(0.0-2.0)). The results of the PCB analyses are presented on **Table 1-41.** Soil boring locations are depicted on **Figure 1-24**. PCB Aroclor results are depicted on **Figure 1-16a** through **1-16e**.

SVOCs

Several SVOCs were detected in at least one sample at a concentration above the respective DNREC-SIRS Screening Level for Soil. The results of the VOC analyses are presented on **Table 1-42**. Soil boring locations are depicted on **Figure 1-24.**

Benzo(a)anthracene was detected above the DNREC-SIRS Screening Level for Soil of 1.1 mg/kg at a concentration of 1.3 mg/kg at RSU-OU-4-5(2.0-3.5).

Benzo(a)pyrene was detected above the DNREC-SIRS Screening Level for Soil of 0.24 mg/kg in four of the five samples collected at concentrations ranging from 0.68 mg/kg in RSU-OU-4-2(0.0-2.0) to 0.96 mg/kg in RSU-OU-4-5(2.0-3.5).

Benzo(b)fluoranthene was detected above the DNREC-SIRS Screening Level for Soil of 1.11 mg/kg at concentrations of 1.8 mg/kg in RSU-OU-4-4(2.0-4.0) and 3.6 mg/kg in RSU-OU-4-5(2.0-3.5)

Dibenz(a,h)anthracene was detected above the DNREC-SIRS Screening Level for Soil of 0.17 mg/kg at concentrations of 0.26 mg/kg in RSU-OU-4-4(2.0-4.0) and 0.41 mg/kg in RSU-OU-4-5(2.0-3.5).

TAL-Metals

Several TAL-metals were detected in at least one sample above the respective DNREC-SIRS Screening Level for Soil. The results of the TAL-metals analyses are presented on **Table 1-43**. Soil boring locations are depicted on **Figure 1-24**.

Antimony was detected above the DNREC-SIRS Screening Level for Soil of 3.1 mg/kg in RSU-OU-4-5(2.0-3.5) at a concentration of 7.79 mg/kg.

Arsenic was detected above the DNREC-SIRS Screening Level for Soil of 11 mg/kg at a concentration of 17.1 mg/kg in RSU-OU-4-5(2.0-3.5).

Nickel was detected above the DNREC-SIRS Screening Level for Soil of 150 mg/kg at concentrations of 328 mg/kg in RSU-OU-4-1(0.0-2.0) and 174 mg/kg in RSU-OU-4-3(0.0-2.0).

Thallium was detected above the DNREC-SIRS Screening Level for Soil of 0.078 mg/kg at concentrations ranging from 0.108 mg/kg in RSU-OU-4-3(0.0-2.0) to 0.276 mg/kg in RSU-OU-4-5(2.0-3.5).

TPH DRO and GRO

TPH-GRO and TPH-DRO was not detected at concentrations above the DNREC-SIRS Screening Level for Soil. The results of the TPH-DRO and TPH-GRO analyses are also presented on **Table 1-41.** Soil boring locations are depicted on **Figure 1-24**.

1.7.1.10.6 Newark Regional Transportation Center (NRTC) Warehouse Project

The Newark Regional Transportation Center (NRTC) Warehouse Project entailed the placement of a pole barn-type structure fastened to asphalt in an area adjacent to the south of the recently constructed Car Shop Relocation Building. The building consisted of a 40 ft. by 80 ft. structure to be used as storage for equipment and materials. The location of the NRTC Warehouse is depicted on **Figure 1-13**.

Two soil borings were advanced within the footprint of the NRTC Building. Representative samples were collected to the top of groundwater in order to characterize the soil within the planned footprint. Six soil borings were advanced at the perimeter to the south, east and west, outside the footprint of the planned structure. These soil borings were used to characterize soil to be left outside the planned project. No soil borings were advanced to the north due to the proximity of the Car Shop Relocation Building. At each of these soil boring locations, representative samples were collected from just below asphalt and subbase stone to the top of the water table.

At each location soil samples were collected in six-inch intervals and screened with a PID. The six-inch interval with the highest PID reading was analyzed for VOCs. If no PID readings were identified in the soil boring, the six-inch interval above the water table was analyzed for VOCs. The two-foot interval that includes the VOC sample was also analyzed for SVOCs, TAL-metals, TPH-DRO, and TPH-GRO. Each two-foot interval to the top of the water table was analyzed for PCBs. Sample analyses were performed by Eurofins Lancaster Laboratories (a DNREC HSCA/VCP certified lab). The laboratory extraction was conducted using USEPA method 3550B (sonication). Soil boring locations are depicted on **Figure 1-25**.

In addition, Amtrak performed soil sampling activities in a 10 ft. by 10 ft. grid within the NRTC Building footprint. Soil samples were collected from the 3-inch interval beneath the existing sub-base stone and were analyzed for PCB Aroclors by EPA method 8082 using EPA method 3550B (sonication).

The project was implemented in accordance with TSCA 40 CFR 761.61(b). A summary of the soil sampling results is provided below. Laboratory analytical data reports are included in **Appendix 1-6**.

VOCs

No VOCs were detected above the DNREC-SIRS Screening Levels in any of the samples collected. The results of the VOC analyses are presented on **Table 1-44**. Soil boring locations are depicted on **Figure 1-25.**

PCBs

A total of 64 samples collected for PCB Aroclors analysis as a part of the initial investigation. Samples were collected consistent with the VCP and in a grid pattern just under the subbase stone in the footprint of the building. Soil borings NRTC-1 through NRTC-4 and NRTC-7 and NRTC-8 were advanced to the west, south, and east of the building footprint (**Figure 1-25**). Soil boring NRTC-5, NRTC-6 and the grid samples were collected within the footprint of the building. No samples were collected to the north of the NRTC footprint because of the proximity to the Car Shop Relocation Building (OU-2 of DE-0266).

Samples collected outside the footprint of the building identified total PCB Aroclors above the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg in four of the 15 soil samples collected ranging from a concentration of 0.42 mg/kg in NRTC-6(2.0-4.0) to 8.4 mg/kg in NRTC-1(0.0-1.5). Soil samples collected within the footprint of the building identified total PCB Aroclors above the DNREC-SIRS Screening Level for Soils of 0.23 mg/kg within the building footprint at concentrations ranging from 0.26 mg/kg in D-8(0.0-0.3) to 12 mg/kg in E-2(0.5-0.8). The results of the PCB analyses are presented on **Table 1-45.** Soil boring locations are depicted on **Figure 1-25**.

Soil sample location E-2 was excavated to a depth of 1.0 ft bgs based on analytical results. Additionally, soil was excavated to the next grid nodes (E-1, D-1, D-2, D-3, and E-3) in order to remove soil that was identified at a concentration greater than 10 mg/kg. Excavated soil was disposed of offsite. Post-excavation soil sampling was conducted at E-2 as well as five feet from this location to the west, north, and south in accordance with 40 CFR 761 Subpart O. Because this location is along the east perimeter of the footprint, no excavation was conducted to the east. Soil outside the footprint of the NRTC building is being addressed under the RSFFS for the Former Fueling Facility (DE-0266) due to its location within the Outfall 007 drainage area.

Prior to placement of the building which consisted of a shed-like structure, anchored to asphalt, asphalt was placed on existing asphalt to a minimum of 6 inches in thickness.

SVOCs

Only benzo(a)pyrene was detected above the respective DNREC-SIRS Screening Level for Soil of 0.24 mg/kg at concentrations ranging from 0.25 mg/kg in NRTC-1(0.0-1.5) to 0.29 mg/kg in NRTC-4(2.0-4.0). The results of the SVOC analyses are presented on **Table 1-46**. Soil boring locations are depicted on **Figure 1-25.**

TAL-Metals

Several TAL-metals were detected in at least one sample above the respective DNREC-SIRS Screening Level for Soil. The results of the TAL-metals analyses are presented on **Table 1-47**. Soil boring locations are depicted on **Figure 1-25**.

Antimony was detected above the DNREC-SIRS Screening Level for Soil of 3.1 mg/kg in four of the soil borings at concentrations ranging from 7.34 mg/kg in NRTC-3(2.0-4.0) to 114 mg/kg in NRTC-1(0.0-1.5).

Arsenic was detected above the DNREC-SIRS Screening Level for Soil of 11 mg/kg in four of the soil borings at concentrations ranging from 11.5 mg/kg in NRTC-3(2.0-4.0) to 24.9 mg/kg in NRTC-5(2.0-4.0).

Barium was detected above the DNREC-SIRS Screening Level for Soil of 1,500 mg/kg in two of the soil borings at concentrations of 4,460 mg/kg in NRTC-3(2.0-4.0) and 3,000 mg/kg in NRTC-5(2.0-4.0).

Copper was detected above the DNREC-SIRS Screening Level for Soil of 310 mg/kg in two of the soil borings at concentrations ranging from 484 mg/kg in NRTC-2(2.0-3.5) to 511 mg/kg in NRTC-1(0.0-1.5).

Lead was detected above the DNREC-SIRS Screening Level for Soil of 400 mg/kg in four of the soil borings at concentrations ranging from 737 mg/kg in NRTC-2(2.0-2.5) to 3,470 mg/kg in NRTC-1(0.0-1.5).

Thallium was detected above the DNREC-SIRS Screening Level for Soil of 0.078 mg/kg in six of the soil borings at concentrations ranging from 0.149 mg/kg in NRTC-8(2.0-3.5) to 0.470 mg/kg in NRTC-5(2.0-4.0).

<u>TPH DRO and GRO</u>

Neither TPH-DRO nor TPH-GRO were detected above their respective DNREC-SIRS Screening Level for Soil. The results of the TPH-DRO and TPH-GRO analyses are also presented on **Table 1-45.** Soil boring locations are depicted on **Figure 1-25**.

1.7.1.11 UST Closure – DAF Building

In August and September 2016, Amtrak completed the closure in-place process for two 10,000-gallon waste oil tanks located at the Wilmington Maintenance Facility (DE-0170) **Figure 1-16a** through **1-16e**) associated with the wastewater treatment facility in Building 38. The tanks were cleaned on August 2, 2016 by Clean Harbors Environmental Services (Clean Harbors). Prior to UST closure activities, Stantec collected a total of 31 soil samples from the perimeter of the USTs and associated piping. The tanks were filled with flowable fill on September 26, 2016 by Lewis Environmental.

The tanks were cleaned using water and approximately two gallons of degreaser. A total of 1,500 gallons of oil and cleaning water were removed from the tanks and disposed of by Clean Harbors. Documentation of the disposal of the residual tank contents and waste generated during UST cleaning is included in the UST Closure Report provided in **Appendix 1-1**.

Soil samples were collected on September 19, 2016 from the perimeter of each of the USTs as well as from the area of the piping runs associated with the tanks. A *Piping Sampling Plan* was submitted to DNREC Tank Management Section (TMS) on August 26, 2016 and was subsequently approved (with the addition of PCB analysis) by DNREC TMS in an email to Stantec on September 7, 2016.

Two samples were collected from each of the 14 locations according to the DNREC *Notification and Soil Sampling Requirements for Closure in Place of Underground Storage Tank Systems* guidance document. One grab sample was collected from each location at the top of the water table (encountered at 4.5 feet below grade) and one composite sample was collected from each location from the area between the surface and the top of the water table. The samples were collected using a Geoprobe dual tube direct push drilling method with retrievable macrocores operated by East Coast Drilling Inc. (ECDI). The soil in each of the macrocores was screened using a PID. Screening results indicated that VOCs were not present at PID-measurable levels in any of the soil borings. The collected samples were submitted to Eurofins Lancaster Laboratory for analysis. Each sample was analyzed for the used oil suite defined in the DRBCAP Tier 0 table. Specifically, the samples were analyzed for GRO, DRO, HRO, Lead, EDB, EDC, MTBE, and BTEX (with benzene also reported separately) and PCBs via EPA method 8082 according to DNREC TMS' request in their September 7, 2016 piping sampling plan approval email.

The results of the sampling indicate that none of the compounds from the waste oil suite were detected at concentrations exceeding the DRBCAP Tier 0 Action Levels. PCB Aroclor 1260 was identified in PIP-3 (39 mg/kg), PIP-4 (0.33 mg/kg), PIP-5 (1.2 mg/kg), and S-3 COMP (0.97 mg/kg) at concentrations exceeding the DNREC SIRS soil screening level of 0.24 mg/kg. The laboratory analytical results are included as **Appendix 1-6** and are summarized on **Table 1-48**.

1.7.2 Groundwater Investigations

Additional remedial investigations were performed in order to characterize site groundwater and the occurrence of light non-aqueous phase liquid (LNAPL) across the Facility since the submittal of the IDS Report. The additional investigations were conducted in accordance with the Revised RI/FFS Work Plan. Groundwater investigations included monitoring well installation, depth to liquids measurements, groundwater sampling and slug testing. LNAPL sampling and laboratory analyses were also performed.

1.7.2.1 Monitoring Well Installation

As described in the IDS Report, monitoring wells NY-MW-1 through NY-MW-24 were installed in the unconfined shallow aquifer across the Facility using hollow-stem auger (HSA) techniques. NY-MW-4 was installed and screened below the clay confining layer using mud-rotary drilling techniques.

Additional wells were installed throughout the Maintenance Facility as part of the RI. Well locations are depicted on **Figure 1-17**. Well completion logs are provided in **Appendix 1-5**.

Monitoring wells NY-MW-25 through NY-MW-57 were completed to depths ranging from 12 feet bgs (NY-MW-52, NY-MW-53, and NY-MW-55) to 23 feet bgs (NY-MW-33R). These wells were generally installed to the top of the clay layer encountered between 8 feet bgs at NY-MW-50 to 22 feet bgs at NY-MW-33R. The well screen in each well extended at least one foot above the water table elevation encountered during drilling; however, due to the shallow occurrence of groundwater at locations NY-MW-51 through NY-MW-55, the well screen was set between 2 and 3 ft. bgs. All wells were constructed of 4 inch-diameter PVC riser and well screen. Monitoring well construction details are summarized on **Table 1-49**.

1.7.2.2 Groundwater Gauging

Synoptic liquids level gauging using an oil/water interface probe was performed periodically. Groundwater gauging data is provided as **Table 1-50**.

Groundwater elevation contour maps were constructed using gauging data from the April 4, 2018 and November 8, 2018 gauging events and are provided as **Figures 1-26** and **1-27**, respectively. Groundwater gradient across the Facility is in a general east-southeasterly direction, from the mainline tracks towards the NED. In the northern portion of the Facility, groundwater gradient is in a more easterly direction towards Shellpot Creek.

During periodic gauging event from 2015 through 2018, LNAPL was encountered at NY-MW-1 at a thickness up to 0.16 ft. (October 18, 2018). LNAPL was also identified in NY-MW-8 during two gauging events at a thickness up to 0.02 ft. (September 26, 2017); in NY-MW-17 during two gauging events at a thickness up to 0.03 ft. (August 3, 2015); and, in NY-MW-18 during all gauging events at a thickness up to 0.78 ft. (November 8, 2018). At all locations, the LNAPL was observed to be moderately to highly weathered.

Monitoring wells NY-MW-51 through NY-MW-55 were installed in the Locomotive Yard to characterize the extent of LNAPL that was observed during the Locomotive Tracks 1, 2, and 3 Replacement Project. There has been no product observed during periodic gauging; however, due to the locally shallow groundwater elevation in that area, the wells are periodically occluded (liquid levels detected above the screened interval). The depth to water in these wells has been observed at less than two feet below the top of casing. The top of the well screens installed for these wells was between 2.0 ft. bgs to 2.5 ft. bgs in order to prevent leakage of surface water into the well.

LNAPL occurrence in the vicinity of MH-14 portion of the Outfall 007 storm sewer system was reported in the PMP Annual Reports. Activities related to investigating the source of LNAPL and isolating the LNAPL from the storm sewer conveyance are summarized below.

- As mentioned in the PMP Annual Report for 2007 (dated March 26, 2008), visual observations of an oil sheen were reported in manhole MH-14 (part of the Outfall 007 storm sewer system) in the vicinity of the Wheel and Locomotive Shops. As a result, an investigation of the occurrence of LNAPL was initiated in the vicinity of Locomotive and Wheel Shops during 2007. Ten one-inch diameter monitoring wells were installed. LNAPL was detected in four wells at apparent product thickness up to 1.56 feet (apparent product thickness is expected to be greater than the true product thickness on the water table due to capillary forces and the small well diameter). PCB Aroclor analyses were performed on two of the LNAPL samples. Total PCB Aroclor concentrations in the two LNAPL samples were 42 mg/kg and 30.6 mg/kg.
- As mentioned in the PMP Annual Report for 2008, during 2008 additional one-inch diameter monitoring wells (piezometers; PZ-11 through PZ-25) were installed to further characterize and delineate the occurrence of LNAPL on the water table surface.
- During April 2009, one-inch diameter monitoring wells PZ-27 through PZ-38 were installed (PZ-26, PZ-31, PZ-34, and PZ-35 were not installed due to refusal on subsurface debris) for further delineate the extent of LNAPL as well as to evaluate potential LNAPL occurrence beneath the buildings. Piezometer/micro-well locations are depicted on **Figure 1-28**.
- Also, during (December) 2009, two eight-inch diameter recovery wells (NY-RW-1 and NY-RW-2) were installed using hollow stem auger well drilling techniques and constructed of PVC well materials. The wells were installed adjacent to the monitoring wells reporting the greatest LNAPL apparent product thicknesses (PZ-8 and PZ-11). The recovery wells were installed with the intention to deploy product skimming pumps in each well. However, LNAPL skimming pumps have not been deployed in these wells because a significant apparent LNAPL thickness has not been recorded in either recovery well. Recovery well locations are depicted on **Figure 1-28**.
- From 2010 through 2018, the monitoring and recovery wells were gauged for depth to LNAPL and water and accumulated LNAPL was manually bailed on a monthly basis. An apparent LNAPL thickness map for measurements recorded on November 7, 2018 is presented as **Figure 1-28**.
- As mentioned in the PMP Annual Report for 2015, recovery wells NY-RW-1 and NY-RW-2, were redeveloped on October 30, 2014 to promote the infiltration of LNAPL. Since the wells have been redeveloped, measurable LNAPL has not increased and has only been detected at a max thickness of 0.01 feet in each of NY-RW-1 in October 2016 and in NY-RW-2 in October 2015.
- On September 22, 2015 LNAPL was observed within MH-14 located between Building 16 and the Wheel Shop. Upon discovery, additional sorbent booms were deployed within and down-gradient of this manhole. LNAPL collected from MH-14 was analyzed for PCBs in oil. PCBs were recorded at 960 mg/kg. Following

sampling activities, the existing boom was replaced with a new sorbent boom within MH-14.

- Additional sampling of the LNAPL in MH-14 was conducted through 2016. Samples were analyzed for PCBs in oil. Results of these sampling events are included on **Table 1-51**. Laboratory analytical results are included in **Appendix 1-7**. PCB results from the September 2015 through June 2016 samples collected from MH-14 are summarized as follows:

    - September 22, 2015 – 960 mg/kg
    - October 8, 2015 – 610 mg/kg
    - October 14, 2015 – 1130 mg/kg
    - January 8, 2016 – 600 mg/kg
    - May 26, 2016 – 430 mg/kg
    - June 7, 2016 – 2,200 mg/kg

In May 2016, Stantec and Video Pipe Services, Inc conducted a pipe video inspection in various storm sewer lines upgradient and downgradient of MH-14. The purpose of this inspection was to assess the condition of the storm sewer piping and presence of LNAPL entering the stormwater conveyance. The video inspection of the storm sewer line immediately upgradient and to the west-northwest of MH-14 indicated an oil stained longitudinal crack in the 18" reinforced concrete pipe. In December 2016, the 48' section of 18-inch concrete storm sewer piping upgradient of MH-14 (which included the oil stained crack section of pipe) connecting to MH-WS-Door#15 was replaced with one continuous section of 18-inch diameter HDPE pipe. The section of piping is depicted on **Figure 1-28**. LNAPL that infiltrated the trench of the excavation was sampled on December 7, 2016 and analyzed for PCBs in oil. As summarized on **Table 1-51**, the LNAPL sample "MH-14_20161207" recorded PCB concentrations of 90 mg/kg. Laboratory analytical results are included in **Appendix 1-7**.

Two standpipes (SP-1 and SP-2) and LNAPL recovery piping with two sumps for potential use in LNAPL recovery (NY-RW-3 and NY-RW-4) were installed in the excavation and backfill of the HDPE storm sewer line. Locations of the replaced storm sewer, standpipes, and sumps and associated piping are depicted in detail on **Figure 1-28**. Following the replacement of the 48-foot section of storm water piping and backfilling with clean quarry material, trace amounts of LNAPL was encountered in the standpipes (SP-1 and SP-2) or sumps (NY-RW-3 and NY-RW-4) for the remainder of 2016. Concrete was placed over the area in May 2017. Routine visual inspections of the storm sewer in the MH-14 area after the pipe replacement project reported no visible LNAPL in the storm water conveyance.

Figure 1-28 presents apparent LNAPL thicknesses and includes data collected during November 7, 2018.

1.7.2.2.1 2015 and 2016 Pit 16 and Pit 17 oil Investigations

Investigations related to the industrial waste sewer identified a source of PCBs in Pit 16 and Pit 17 within Building 7. A summary of investigations through 2014 was included in the IDS Report.

Building 7 Pits 16 and 17 were isolated from the industrial waste sewer with inflatable plugs to prevent pit water from entering the industrial waste sewer system. On February 25, 2015 Amtrak and Stantec were notified during a site walk that water had accumulated in the Track #17 inspection pit. During investigations of this pit, a thin sheen of oil was observed on the surface of the water. The oil did not appear to be similar to diesel fuel at the time of the inspection. The inflatable plugs prevented the water from migrating through the industrial waste sewer conveyance. An absorbent pad was used to soak up some of the oil in order to run analysis for PCBs in Oil. The analytical results for this sample (Track-17 Pad) identified PCBs in Oil on the pad at a concentration of 310 mg/kg.

On March 9, 2015 and April 9, 2015, PCBs in Oil samples were subsequently collected of oil only from the Track #17 inspection pit. PCBs in Oil were identified at concentrations of 147 mg/kg and 77 mg/kg, respectively. The pit was cleaned after these sampling events. The results of the 2015 investigations are summarized on **Table 1-52**.

On June 30, 2016 an accumulation of oil was noted in the pit near the drainpipe on the south end of Pit #17. There were two different visual characteristics of the oil identified in the pit at the time. One was noted to be dark brown oil while the other was noted to be a whitish film. A sample of each type of oil was collected for PCBs in Oil as well as GC fingerprint analysis. The dark brown oil (Pit-17-Oil) identified PCBs at a concentration of 580 mg/kg. The whitish film (Pit-17-Film) identified PCBs in Oil at a concentration of 400 mg/kg. GC fingerprint analysis identified both oils to be comparable to motor oil with a small portion resembling diesel fuel (2% of each of the samples). Track #17 inspection pit was cleaned by Clean Harbors on July 29, 2016.

During another site visit on August 23, 2016, oil was observed in the pit by the drain at the south end of the Track #17 pit. A sorbent pad was placed on the accumulated oil and the pad was sent for analysis of PCBs in Oil. The analytical results identified PCBs in Oil at a concentration of 450 mg/kg. The results of the 2016 PCB investigations are summarized on **Table 1-52**.

In order to further identify the source of the oil, the water in IW-MH-5 was pumped into a tote in order to video inspect the line with a fiber optic camera. The camera was unable to be pushed through the line due to the several turns that the line made. An evaluation was conducted at Track #17 and Track #16 pits in order to determine how the lines connect to the industrial waste sewer. It was determined that only Track #17 pit connects to IW-MH-5. Track Pit #16 connects to the industrial waste sewer between IW-MH-5 and the manhole downgradient of IW-MH-5.

Water was observed to be infiltrating back into IW-MH-5 from the piping between the manhole and Track #17 pit. Once a sufficient amount of water had entered the manhole, the water was pumped into a tote. At the end of the pumping, oil was identified coming from the piping. The infiltration of oil stopped, and the manhole was permitted to fill with water again. The water was again pumped, and oil was observed to be coming from the piping. A sample of the oil infiltrating the manhole was analyzed for PCBs in Oil. PCBs were identified in this sample at a concentration of 680 mg/kg. At the conclusion of this investigation, the pipe in IW-MH-5 and the pipes leaving Pits-16 and 17 were sealed with hydraulic concrete with a small amount of bentonite added to prevent flow from the pits into the industrial waste system. Analytical data reports are provided in **Appendix 1-7**.

1.7.2.2.2 2017 Pit 16 and Pit 17 Oil Investigations

Accumulating oil was identified in Pits 16 and 17 of Building 7 during 2017. An oil sample was collected on June 7, 2017 from Pit 17 and analyzed for PCBs in Oil by EPA method 8082. Total PCB Aroclors were identified at a concentration of 219 mg/kg. An additional sample was collected on June 27, 2017 from Pit 17 and analyzed for PCBs in oil as well as GC Fingerprint. Total PCB Aroclors were identified at a concentration of 155 mg/kg. The GC Fingerprint analysis determined the oil was most similar to a mixture of diesel fuel (at 34% of the composition) and motor oil (at 33 % of the composition). Analytical results for total PCB Aroclors and GC Fingerprint are provided on **Table 1-52**.

Prior to cleaning Pits 16 and 17, a sample was collected on September 19, 2017 from Pit 16 and analyzed for PCBs in oil and GC Fingerprint. Total PCB Aroclors were identified at a concentration of 47 mg/kg. The GC Fingerprint analysis determined the oil was most similar to motor oil (at 62% of the composition). Analytical results for total PCB Aroclors and GC Fingerprint are provided on **Table 1-52**.

In October 2017, the fluids were pumped out of Pits 16 and 17 and containerized. After the removal of the fluids, standpipes were installed at the bottom of the pits. The standpipes were constructed of 2-inch diameter PVC with 0.010 slotted well screen from the bottom of the boring to approximately 0.7 ft. below the top of concrete. The annular space was filled with clean sand to just above the screen and finished with a layer of bentonite and concrete. A locking cap was placed on the standpipes. There was no LNAPL observed in the standpipes during any inspections since the installation of the standpipes.

After the completion of the standpipe installation, the two pits were cleaned using a surfactant (Simple Green) and water rinse. All cleaning fluids were containerized for disposal. Any standing water left in the pits was removed so that any fluids observed in the future could be easily identified.

1.7.2.2.3 2018 Pit 16 and 17 Oil Investigations

In early September 2018 oil was again identified in Pit 16 and 17. An oil sample was collected from both pits and analyzed for PCBs in oil by 8082. Total PCB Aroclors were identified at a concentration of 190 mg/kg in Pit-16 and 300 mg/kg in Pit-17. Analytical results for total PCB Aroclors are provided on **Table 1-52**.

In October 2018, the fluids were pumped out of Pits 16 and 17 and containerized. The two pits were cleaned using a surfactant (Simple Green) and water rinse. All cleaning fluids were containerized for disposal. Any standing water left in the pits was removed so that any fluids observed in the future could be easily identified.

In November 2018, during a routine inspection of Pits 16 and 17, a small amount of oil was observed to be leaking into Pit 16 from the west wall at what appeared to be a former conduit cutout. A sorbent pad was placed at this location in order to collect oil. The pad as well as oil in the Pit 16 were analyzed for PCB Aroclors. Total PCB Aroclors in the pad sample were identified at a concentration of 26 mg/kg. The oil sample identified total PCB Aroclors at a concentration of 52 mg/kg. PCB analytical results are provided on **Table 1-52**. A summary of the nature and extent of the LNAPL identified in Pits 16 and 17 is presented in Section 1.9.

1.7.2.3 Groundwater Sampling and Analyses

Several rounds of groundwater sampling were conducted from 2015 through 2018. Samples were collected from all monitoring wells in the study area except where measurable LNAPL was observed. Groundwater sampling was conducted to assess groundwater conditions over time, assess site-wide conditions as new wells were installed and assess the performance of the ERD filed-scale pilot test. A summary of groundwater sampling and analytical results is provided by sampling event below.

At each well location, the groundwater was purged of three well volumes or until the well went dry using a submersible pump to ensure the collection of representative groundwater samples. During purging, field measurements of temperature, pH, specific conductance, redox potential, and dissolved oxygen were recorded (field parameter results are summarized on **Table 1-53**). Well purging and sampling equipment were decontaminated between each well.

1.7.2.3.1 June 2015 Groundwater Sampling

On June 23 and 24, 2015 groundwater samples were collected from monitoring wells NY-MW-2 through NY-MW-4, NY-MW-6, NY-MW-10, NY-MW-15, NY-MW-19, NY-MW-20, and NY-MW-21. These wells had previously reported concentrations of cVOCs or are within the general vicinity of the wells reporting these compounds.

Each sample was analyzed for VOCs by Eurofins Lancaster Laboratories using method 8260. After purging, the samples were collected using a dedicated bailer. A summary of the groundwater sampling results is provided below. Laboratory analytical results are summarized on **Table 1-54**. Monitoring well locations are depicted on **Figure 1-17**. Analytical results for the June 2015 sampling event are depicted on **Figure 1-29**. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l in NY-MW-19 at a concentration of 4 ug/l.

1,1, Dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 7 ug/l in NY-MW-2 at a concentration of 35 ug/l.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l in four of nine locations sampled at concentrations ranging from 10 ug/l at NY-MW-15 to 5,700 ug/l at NY-MW-2.

Trans-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 36 ug/l in NY-MW-2 at a concentration of 47 ug/l.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 1 ug/l in NY-MW-6 at a concentration of 2 ug/l.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in five of nine locations sampled at concentrations ranging from 2 ug/l at NY-MW-4 to 6,600 ug/l at NY-MW-2.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in three of nine locations sampled at concentrations of 1 ug/l at NY-MW-3 and 250 ug/l at NY-MW-2.

1.7.2.3.2 August and September 2015 Groundwater Sampling

In August and September 2015 groundwater sampling was conducted at NY-MW-2 through NY-MW-16, NY-MW-19 through NY-MW-42 (monitoring wells NY-MW-27, NY-MW-30, and NY-MW-31 were not installed due to subsurface obstructions). Groundwater samples were not collected at NY-MW-1, NY-MW-17 and NY-MW-18 due to the presence of LNAPL. Monitoring well locations are depicted on **Figure 1-17**.

Each sample was analyzed for VOCs by EPA method 8260, SVOCs by EPA method 8270, and field filtered TAL-Metals by EPA method 6010 by Eurofins Lancaster Laboratories. The samples were collected using a dedicated bailer. Samples collected for TAL-metals were field filtered through a 0.45-micron filter. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

It should be noted that during this event, one cooler was received by Eurofins Lancaster Labs above temperature. The results for VOCs, SVOCs, and TAL-metals are reported here as reference and in context with samples collected during the same timeframe. The samples effected include NY-MW-6, NY-MW-7, NY-MW-19, NY-MW-25, NY-MW-34.

Groundwater samples were analyzed for PCB Aroclors using low-level methodology by Test America Laboratory in Pittsburgh, Pennsylvania on unfiltered and filtered samples during sampling events conducted in August and September 2015. Additional groundwater samples were collected from NY-MW-14, NY-MW-15, NY-MW-16, NY-MW-22, NY-MW-23, NY-MW-24, and NY-MW-35 and analyzed for PCB congeners by EPA method 1668A by Test America Laboratory in Knoxville, Tennessee. The congener samples were filtered by the lab using a 1.0-micron filter.

PCB Aroclor Results – Unfiltered Samples

At least one PCB Aroclor was detected above the DNREC-SIRS Screening Level for Groundwater in 25 of the 35 samples collected. Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in 21 of 35 locations sampled at concentrations ranging from 0.0094 ug/L for Aroclor 1260 at NY-MW-4 to 9.7 ug/L for Aroclor 1260 in NY-MW-5. Aroclor 1254 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in four of 35 locations sampled at concentrations ranging from 0.041 ug/l in NY-MW-9 to 0.15 ug/l in NY-MW-35 and NY-MW-40. Aroclor 1248 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in 13 of 35 locations sampled at concentrations ranging from 0.0089 ug/l in NY-MW-11 to 0.36 ug/l in NY-MW-12. PCB analytical results are provided on **Table 1-55**.

Total PCB concentrations were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/L in 20 of the 35 unfiltered samples at concentrations ranging from 0.052 ug/l at NY-MW-22 to 9.7 ug/l at NY-MW-5. PCB analytical results are depicted on **Figure 1-30**.

PCB Aroclor Results – Filtered Samples

Samples collected for PCB Aroclors were field filtered using a 0.45-micron filter. PCB concentrations in filtered samples were significantly lower than in unfiltered samples, although, at least one PCB Aroclor was detected above the DNREC-SIRS Screening Level for Groundwater in four of the 35 filtered samples collected. Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in four of 35 locations sampled at concentrations ranging from 0.0094 ug/L at NY-MW-22 to 0.35 ug/L in NY-MW-16 collected during the September 3, 2015 sampling event. Aroclor 1254 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l at a concentration of 0.032 ug/l in NY-MW-40. Aroclor 1248 was not detected above the method detection limit in any of the filtered samples. PCB analytical results are provided on **Table 1-55**. Monitoring well locations are depicted on **Figure 1-30**.

Total PCB concentrations were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/L in two of the 35 filtered samples collected for PCBs at concentrations of 0.35 ug/l at NY-MW-16 and 0.063 ug/l at NY-MW-40 collected during the September 3, 2015 sampling event. PCB analytical results are provided on **Table 1-55** and depicted on **Figure 1-30**.

PCB Congener Results – Filtered Samples

Groundwater samples were collected from monitoring wells NY-MW-14, NY-MW-15, NY-MW-16, NY-MW-22, NY-MW-23, NY-MW-24, and NY-MW-35 during the September 2015 sampling event and analyzed for PCB congeners by EPA method 1668A to characterize PCBs at the perimeter of the property. Samples were also collected from these wells for PCB Aroclors and analyzed by low level detection EPA method 8082 for comparison purposes and were previously summarized. The congener samples were filtered by the lab using a 1.0-micron filter.

PCB congeners were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/l in NY-MW-16 at a concentration of 0.191 ug/l, NY-MW-22 at a concentration of 0.394 ug/l, and NY-MW-35 at a concentration of 0.0478 ug/l. The PCB congener and Aroclor results are provided on **Table 1-55** and depicted on **Figure 1-30**.

VOC Results

During the August 2015 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Level for Groundwater. The results are summarized below.

Bromodichloromethane was detected above the DNREC-SIRS Screening Level for Groundwater of 0.13 ug/l in NY-MW-20 at a concentration of 2 ug/l.

Chlorobenzene was detected above the DNREC-SIRS Screening Level of 7.8 ug/l in NY-MW-8 at a concentration of 99 ug/l and NY-MW-16 at a concentration of 23 ug/l.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l in nine of 35 locations sampled at concentrations ranging from 1 ug/l at NY-MW-33 and NY-MW-34 to 31 ug/l at NY-MW-20.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l in seven of 35 locations sampled at concentrations ranging from 4 ug/l at NY-MW-29 to 1,100 ug/l at NY-MW-21.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 1 ug/l in five of 35 locations sampled at concentrations ranging from 2 ug/l at NY-MW-40 to 16 ug/l at NY-MW-37.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in 11 of 35 locations sampled at concentrations ranging from 1 ug/l at NY-MW-4 to 3,400 ug/l at NY-MW-26.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in three of 35 locations sampled at concentrations ranging from 4 ug/l at NY-MW-21 to 39 ug/l at NY-MW-2.

Laboratory analytical results are summarized on **Table 1-56**.

<u>SVOC Results</u>

During the August 2015 sampling event, groundwater samples analyzed for SVOCs were compared to the DNREC-SIRS Screening Level for Groundwater. The results are summarized below.

Benzo(a)pyrene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.025 ug/l in NY-MW-5 at a concentration of 0.6 ug/l.

Benzo(b)fluoranthene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.25 ug/l in NY-MW-5 at a concentration of 1 ug/l.

Dibenzofuran was detected above the DNREC-SIRS Screening Level for Groundwater of 0.79 ug/l in five of 35 locations sampled at concentrations ranging from 1 ug/l at NY-MW-8, NY-MW10, NY-MW-13, and NY-MW-36 to 2 ug/l at NY-MW-33.

1,4-Dichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.48 ug/l in four of 35 locations sampled at concentrations ranging from 1 ug/l at NY-MW-8 and NY-MW-21 to 3 ug/l at NY-MW-29.

Bis(2-ethylhexyl)phthalate was detected above the DNREC-SIRS Screening Level for Groundwater of 5.6 ug/l in NY-MW-14 at a concentration of 18 ug/l.

Indeno(1,2,3-cd)pyrene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.25 ug/l in NY-MW-5 at a concentration of 0.6 ug/l.

Naphthalene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.17 ug/l at a concentration of 0.8 ug/l at NY-MW-8 and 1 ug/l at NY-MW-32.

1,2,4-Trichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.4 ug/l in three of 35 locations sampled at concentrations ranging from 2 ug/l at NY-MW-21 to 5 ug/l at NY-MW-21.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-57**. It should be noted that groundwater at NY-MW-5 recharges very slow. Concentrations of SVOCs at this location are likely related to the entrainment of suspended solids within the sample.

<u>TAL – Metals Results – Filtered Samples</u>

During the August 2015 sampling event, groundwater was field filtered by passing the sample through a 0.45-micron filter and analyzing for TAL-metals. The following constituents were detected above the DNREC-SIRS Screening Level in Groundwater.

Aluminum was detected above the DNREC-SIRS Screening Level for Groundwater of 2 mg/l in three of 35 locations sampled at concentrations ranging from 2.21 mg/l at NY-MW-41 to 7.37 mg/l at NY-MW-5.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l at concentrations of 0.144 mg/l at NY-MW-5 and 0.0241 mg/l at NY-MW-11.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l in seven of 35 locations sampled at concentrations ranging from 0.437 mg/l at NY-MW-9 to 2.03 mg/l at NY-MW-16.

Chromium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.01 mg/l at NY-MW-5 at a concentration of 0.0241 mg/l.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l in 14 of 35 locations sampled at concentrations ranging from 0.0053 mg/l at NY-MW-28 to 0.0419 mg/l at NY-MW-26.

Copper was detected above the DNREC-SIRS Screening Level for Groundwater of 0.08 mg/l at NY-MW-5 at a concentration of 0.0978 mg/l.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in 25 of 35 locations sampled at concentrations ranging from 1.77 mg/l at NY-MW-26 to 360 mg/l at NY-MW-5.

Lead was detected above the DNREC-SIRS Screening Level for Groundwater of 0.015 mg/l in NY-MW-11 at a concentration of 0.0187 mg/l and NY-MW-5 at a concentration of 0.465 mg/l.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in 33 of 35 locations sampled at concentrations ranging from 0.135 mg/l at NY-MW-20 to 6.06 mg/l at NY-MW-26.

Selenium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.01 mg/l at NY-MW-5 at a concentration of 0.0573 mg/l.

Vanadium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0086 mg/l in NY-MW-5 at a concentration of 0.105 mg/l and NY-MW-8 at a concentration of 0.0125 mg/l.

Zinc was detected above the DNREC-SIRS Screening Level for Groundwater of 0.6 mg/l at NY-MW-5 at a concentration of 0.763 mg/l.

Mercury was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000063 mg/l at NY-MW-5 at a concentration of 0.0247 mg/l.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-58**. It should be noted that groundwater in monitoring well NY-MW-5 recharges slowly (indicative of fine-grained materials). Concentrations of TAL-Metals detected at this location are likely related to the entrainment of suspended solids small enough to pass through the 0.45-micron filter.

1.7.2.3.3 July 2016 Groundwater Sampling

Groundwater sampling was conducted at NY-MW-25 through NY-MW-48. Monitoring wells NY-MW-27, NY-MW-30, NY-MW-31, NY-MW-39, and NY-MW-47 were not installed due to subsurface obstructions. No monitoring wells identified as NY-MW-43 or NY-MW-44 were installed at the Facility. Monitoring well locations are depicted on **Figure 1-17**.

Each sample was analyzed by Eurofins Lancaster Laboratories for VOCs by EPA method 8260, SVOCs by EPA method 8270, and field filtered TAL-Metals by EPA method 6010. Filtered and unfiltered samples were collected from each well and analyzed for PCB Aroclors by EPA method 8082 using low level methodology by Test America Labs in Pittsburgh, PA. After purging of the wells, the samples were collected using a dedicated bailer. Filtered samples collected for TAL-metals and PCB Aroclors were field filtered through a 0.45-micron filter. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

<u>PCB Aroclor Results – Unfiltered Samples</u>

PCB Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in two of the 17 locations at concentrations of 0.36 ug/l at NY-MW-40 and 0.094 ug/l at NY-MW-46. PCB analytical results are provided on **Table 1-59**. Monitoring well locations are depicted on **Figure 1-17**. Total PCB concentrations were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/L at the locations and concentrations mentioned above. PCB analytical results are depicted on **Figure 1-30**.

<u>PCB Aroclor Results – Filtered Samples</u>

Samples collected for PCB Aroclors were field filtered using a 0.45-micron filter. Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l at a concentration of 0.032 ug/l in NY-MW-40. Total PCB Aroclors were not detected above the DNREC-SIRS Screening Level for Groundwater any of the filtered samples. PCB analytical results are provided on **Table 1-59**. Monitoring well locations are depicted on **Figure 1-17**. PCB analytical results are depicted on **Figure 1-30**.

<u>VOC Results</u>

During the July 2016 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l at NY-MW-25 at a concentration of 2 ug/l and NY-MW-28 at a concentration of 3 ug/l.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l in three of 17 locations sampled at concentrations ranging from 47 ug/l at NY-MW-29 to 1,300 ug/l at NY-MW-26.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 1 ug/l at concentrations of 14 ug/l in NY-MW-34 and 15 ug/l in NY-MW-37.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in five of 17 locations sampled at concentrations ranging from 4 ug/l at NY-MW-34 and NY-MW-37 to 4,400 ug/l at NY-MW-26.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l at concentrations of 1 ug/l in NY-MW-28 and 8 ug/l in NY-MW-26.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-60**.

SVOC Results

During the July 2016 sampling event, groundwater samples analyzed for SVOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Dibenzofuran was detected above the DNREC-SIRS Screening Level for Groundwater of 0.79 ug/l at concentrations of 1 ug/l in NY-MW-48 and 2 ug/l in NY-MW-46.

1,4-Dichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.48 ug/l at concentrations of 1 ug/l in NY-MW-40 and 2 ug/l in NY-MW-29.

Naphthalene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.17 ug/l at concentrations of 0.6 ug/l in NY-MW-45 and 0.9 ug/l in NY-MW-48.

1,2,4-Trichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.4 ug/l at a concentration of 1 ug/l in NY-MW-26 and NY-MW-40.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-61**.

TAL – Metals Results – Filtered Samples

During the July 2016 sampling event, groundwater was field filtered by passing the sample through a 0.45-micron filter and analyzing for TAL-metals. The following constituents were detected above the DNREC-SIRS Screening Level for Groundwater.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l in nine of 17 locations sampled at concentrations ranging from 0.0065 mg/l at NY-MW-45 to 0.0435 mg/l at NY-MW-26.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in nine of 17 locations sampled at concentrations ranging from 2.41 mg/l at NY-MW-38 to 22.8 mg/l at NY-MW-45.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in all 17 locations sampled at concentrations ranging from 0.0514 mg/l at NY-MW-40 to 5.69 mg/l at NY-MW-26.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-62**.

1.7.2.3.4 November 2016 Groundwater Sampling

During the November 2016 groundwater sampling event, Facility monitoring wells NY-MW-45, NY-MW-46 and NY-MW-48 were sampled. At each well location, the groundwater was purged of three well volumes or until the well went dry using a submersible pump to ensure the collection of representative groundwater samples. During purging, field measurements of temperature, pH, specific conductance, redox potential, and dissolved oxygen were recorded (field parameter results are summarized on **Table 1-53**). Well purging and sampling equipment were decontaminated between each well. Each sample was analyzed for VOCs by EPA method 8260, SVOCs by EPA method 8270, and field filtered TAL-Metals using EPA method 6010 by Eurofins Lancaster Laboratories. Samples were also collected and analyzed for filtered and unfiltered PCB Aroclors by EPA method 8082 using low level detection methodology. After the wells were purged, samples were collected using a dedicated bailer. Filtered samples collected for TAL-metals and PCB Aroclors were field filtered through a 0.45-micron filter. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

PCB Aroclor Results – Unfiltered Samples

At least one PCB Aroclor was detected above the DNREC-SIRS Screening Levels for Groundwater in two of the three samples collected. Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in two of the three locations sampled at concentrations of 0.015 ug/l in NY-MW-45 and 0.032 ug/l in NY-MW-46. Aroclor 1254 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in two of the three locations sampled at concentrations of 0.0082 ug/l in

NY-MW-45 and 0.028 ug/l in NY-MW-46. PCB analytical results are provided on **Table 1-63**. Monitoring well locations are depicted on **Figure 1-17**.

Total PCB concentrations were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/l in two of the three unfiltered locations sampled for PCBs at concentrations of 0.0232 ug/l in NY-MW-45 and 0.06 ug/l in NY-MW-46. PCB analytical results are depicted on **Figure 1-30**.

PCB Aroclor Results – Filtered Samples

Samples collected for PCB Aroclors were field filtered using a 0.45-micron filter. There were no PCB Aroclors detected above the method detection limits in any of the filtered samples collected during the November 2016 groundwater sampling event. PCB analytical results are provided on **Table 1-63**. Monitoring well locations are depicted on **Figure 1-17**. PCB analytical results are depicted on **Figure 1-30**.

VOC Results

During the November 2016 groundwater sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. There were no VOCs detected above the DNREC-SIRS Screening Level for Groundwater in any of the samples collected.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-64**.

SVOC Results

During the November 2016 sampling event, groundwater samples analyzed for SVOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. Only dibenzofuran was detected above the DNREC-SIRS Screening Level for Groundwater of 0.79 ug/l at a concentration of 3 ug/l in NY-MW-48.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-65**.

TAL – Metals Results – Filtered Samples

During the November 2016 sampling event, groundwater was field filtered by passing the sample through a 0.45-micron filter and analyzing for TAL-metals. The following constituents were detected above the DNREC-SIRS Screening Levels in Groundwater.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l at concentrations of 0.0075 mg/l in NY-MW-45 and 0.0172 mg/l in NY-MW-46.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in all three locations sampled at concentrations ranging from 8.57 mg/l in NY-MW-46 to 27.9 mg/l in NY-MW-48.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in all three locations sampled at concentrations ranging from 0.694 mg/l in NY-MW-48 to 4.19 mg/l in NY-MW-45.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-66**.

1.7.2.3.5 April 2018 Groundwater Sampling

Groundwater samples were collected from all site wells located in the Maintenance Facility, including NY-MW-2 through NY-MW-50 (NY-MW-27, NY-MW-39, NY-MW-43, NY-MW-44, and NY-MW-47 were not installed) during the April 2018 sampling event. Groundwater samples were not collected from NY-MW-1, NY-MW-17, or NY-MW-18 due to the presence of LNAPL. Each location was sampled and analyzed for VOCs by EPA method 8260.

Additionally, newly installed monitoring wells NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R, and NY-MW-51 through NY-MW-55 were also sampled and analyzed by Eurofins Lancaster Laboratories for SVOCs by EPA method 8270, and filtered and unfiltered TAL-Metals by EPA method 6020. Samples were also collected at NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R and NY-MW-51 through NY-MW-55 for filtered and unfiltered PCB Aroclors by EPA method 8082 using low level detection methodology by Test America Labs in Pittsburgh, PA. After purging the samples were collected using a dedicated bailer. Filtered samples collected for TAL-metals and PCB Aroclors were field- filtered through a 0.45-micron filter. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

PCB Aroclor Results – Unfiltered Samples

PCB Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0078 ug/l in NY-MW-11R at a concentration of 0.87 ug/l and in NY-MW-55 at a concentration of 0.10 ug/l. PCB analytical results are provided on **Table 1-67**. Monitoring well locations are depicted on **Figure 1-17**.

Total PCB concentrations were detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/l at a concentration of 0.87 ug/l in NY-MW-11R and 0.10 ug/l in NY-MW-55. PCB analytical results are depicted on **Figure 1-30**.

PCB Aroclor Results – Filtered Samples

Samples collected for PCB Aroclors were field filtered using a 0.45-micron filter. There were no PCB Aroclors detected above the method detection limits for filtered samples during the April 2018 sampling event. PCB analytical results are provided on **Table 1-67**.

VOC Results

During the April 2018 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Chlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 7.8 ug/l at NY-MW-8 at a concentration of 120 ug/l.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l in three of the 45 locations at concentrations of 2 ug/l in NY-MW-19 and NY-MW-25 and at a concentration of 1 ug/l in NY-MW-41.

1,1-Dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 7 ug/l at a concentration of 38 ug/l in NY-MW-2.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l in nine of 45 locations at concentrations ranging from 9 ug/l in NY-MW-15 to 7,900 ug/l in NY-MW-2.

Trans-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 36 ug/l at a concentration of 56 ug/l in NY-MW-2.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level of for Groundwater 1 ug/l in four of 45 locations sampled at concentrations ranging from 2 ug/l in NY-MW-54 to 11 ug/l in NY-MW-37.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in 12 of 45 locations sampled at concentrations ranging from 1 ug/l in NY-MW-6 to 11,000 ug/l in NY-MW-31.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in three of 45 locations sampled at concentrations ranging from 2 ug/l in NY-MW-28 to 240 ug/l in NY-MW-29.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-68**. VOC results are also summarized on **Figure 1-31**.

Groundwater isoconcentration maps for TCE, cis-1,2-dichloroethene, and vinyl chloride for the April 2018 groundwater sampling event are provided as **Figures 1-32**, **1-33**, and **1-34**, respectively. These maps conceptually depict the approximate extent of cVOCs in the groundwater at the Facility.

SVOC Results

During the April 2018 sampling event, groundwater samples analyzed for SVOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. Only 1,2,4-Trichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.4 ug/l in NY-MW-31 at a concentration of 1 ug/l.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-69**.

TAL – Metals Results – Unfiltered Samples

During the April 2018 sampling event, groundwater was analyzed for unfiltered TAL-metals. The following constituents were detected above the DNREC-SIRS Screening Level in Groundwater.

Aluminum was detected above the DNREC-SIRS Screening Level for in Groundwater of 2 mg/l at concentrations of 2.60 mg/l in NY-MW-9R and 9.97 mg/l in NY-MW-11R.

Antimony was detected above the DNREC-SIRS Screening Level for Groundwater of 0.00078 mg/l at a concentration of 0.0053 mg/l in NY-MW-9R.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l at a concentration of 0.0035 mg/l in NY-MW-9R.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l at concentrations of 0.423 mg/l in NY-MW-11R and 0.492 mg/l in NY-MW-33R.

Chromium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.01 mg/l at a concentration of 0.0126 mg/l in NY-MW-11R.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l at all 10 locations sampled at concentrations ranging from 0.0013 mg/l in NY-MW-51 to 0.0318 mg/l in NY-MW-33R.

Copper was detected above the DNREC-SIRS Screening Level for Groundwater of 0.08 mg/l at a concentration of 0.0109 mg/l in NY-MW-55.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in six of 10 locations sampled at concentrations ranging from 2.09 mg/l in NY-MW-53 to 33.7 mg/l in NY-MW-33R.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in all 10 locations sampled at concentrations ranging from 0.0788 mg/l in NY-MW-51 to 7.22 mg/l in NY-MW-33R.

Vanadium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0086 mg/l at a concentration of 0.0158 mg/l in NY-MW-11R.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-70**.

<u>TAL – Metals Results – Filtered Samples</u>

During the April 2018 sampling event, groundwater was field filtered by passing the sample through a 0.45-micron filter and analyzing for TAL-metals. The following constituents were detected above the DNREC-SIRS Screening Level in Groundwater.

Antimony was detected above the DNREC-SIRS Screening Levels for Groundwater of 0.00078 mg/l at a concentration of 0.0061 mg/l in NY-MW-9R.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l at a concentration of 0.478 mg/l in NY-MW-33R.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l in nine of 10 locations sampled at concentrations ranging from 0.0013 mg/l in NY-MW-51 to 0.0324 mg/l in NY-MW-33R.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in four of 10 locations sampled at concentrations ranging from 1.61 mg/l in NY-MW-53 to 34.7 mg/l in NY-MW-33R.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in all 10 locations sampled at concentrations ranging from 0.0853 mg/l in NY-MW-51 to 7.26 mg/l in NY-MW-33R.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-70**.

1.7.2.3.6 July and August 2018 Groundwater Sampling

Groundwater samples were collected from site wells located in the Maintenance Facility, including NY-MW-2 through NY-MW-4, NY-MW-6, NY-MW-9R, NY-MW-11R, NY-MW-15, NY-MW-20, NY-MW-21, NY-MW-25, NY-MW-26, NY-MW-28, NY-MW-30 through NY-MW34 (not including NY-MW-33), NY-MW-37, NY-MW-41, and NY-MW-51 through NY-MW55 during the July 2018 groundwater sampling event. In August 2018 an additional sample was collected from NY-MW-31 in order to verify the concentrations of cVOCs identified in the July 2018 sampling event.

VOC samples collected from NY-MW-2 through NY-MW-4, NY-MW-6, NY-MW-15, NY-MW-20, NY-MW-21, NY-MW-25, NY-MW-26, NY-MW-28, NY-MW-30 through NY-MW-34 were collected in order to develop a baseline VOC concentration prior to the implementation of the Enhanced Reductive Dechlorination (ERD) injection pilot test. The ERD injections and additional monitoring and sampling related to this pilot test will be discussed further in Section 3.5.

Each sample was analyzed for VOCs by EPA method 8260. Newly installed monitoring wells NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R, and NY-MW-51 through NY-MW-55 were also sampled and analyzed by Eurofins Lancaster Laboratories for SVOCs by EPA method 8270, and filtered TAL-Metals by EPA method 6020. Samples were also collected and analyzed for filtered and unfiltered PCB Aroclors by method 8082 using low level detection methodology by Test America Labs in Pittsburgh, PA. Filtered samples collected for TAL-metals and PCB Aroclors were field filtered through a 0.45-micron filter. The groundwater laboratory analytical data packages and validation reports are provided in **Appendix 1-8**.

PCB Aroclor Results – Filtered Samples

There were no detections of PCB Aroclors in any filtered sample collected from NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R or NY-MW-51 through NY-MW-55 during the July 2018 sampling event. There were no samples analyzed for PCBs during the August 2018 sampling event. PCB analytical results are provided on **Table 1-71**. Monitoring well locations are depicted on **Figure 1-17**. PCB analytical results are depicted on **Figure 1-30**.

VOC Results

During the July and August 2018 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l at two of the 24 locations sampled at a concentration of 2 ug/l in NY-MW-25 and 1 ug/l in NY-MW-41.

1,1-Dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 7 ug/l in two of the 24 locations sampled at a concentration of 30 ug/l in NY-MW-2 and 15 ug/l in NY-MW-31 during the August 2018 event.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l at eight of the 24 locations sampled at concentrations ranging from 9 ug/l in NY-MW-15 to 7,900 ug/l in NY-MW-2.

Trans-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 36 ug/l at one of the 24 locations sampled at a concentration of 47 ug/l in NY-MW-2.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 1 ug/l at five of the 24 locations sampled at concentrations ranging from 2 ug/l in NY-MW-54 to 11 ug/l in NY-MW-37 and NY-MW-31 during the August 2018 event.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in 11 of the 24 locations sampled at concentrations ranging from 3 ug/l in NY-MW-6 to 69,000 ug/l in NY-MW-31. The sample collected at NY-MW-31 was used to verify the concentration of TCE identified during the July 2018 sampling event. The July 2018 sampling event identified TCE at a concentration of 40,000 ug/l in NY-MW-31.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in seven of the 24 locations sampled at concentrations ranging from of 1 ug/l in NY-MW-21 and NY-MW-28 to 190 ug/l in NY-MW-2.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-72**. VOC analytical results are summarized on **Figure 1-35**. Isoconcentration maps for TCE, cis-1,2-dichloroethene and vinyl chloride are provided as **Figures 1-36**, **1-37**, and **1-38**, respectively.

<u>SVOC Results</u>

During the July 2018 sampling event, groundwater samples were collected from NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R and NY-MW-51 through NY-MW-55 and were analyzed for SVOCs and compared to the DNREC-SIRS Screening Levels for Groundwater. There were no samples analyzed for SVOCs during the August 2018 sampling event. The results are summarized below.

1,4-Dichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.48 ug/l in NY-MW-31 at a concentration of 5 ug/l.

1,2,4-Trichlorobenzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.4 ug/l in NY-MW-31 at a concentration of 17 ug/l.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-73**.

TAL – Metals Results – Filtered Samples

During the July 2018 sampling event, groundwater from NY-MW-9R, NY-MW-11R, NY-MW-30, NY-MW-31, NY-MW-33R, and NY-MW-51 through NY-MW-55 was field filtered by passing the sample through a 0.45-micron filter and analyzing for TAL-metals. There were no samples analyzed for TAL-metals during the August 2018 sampling event. The following constituents were detected above the DNREC-SIRS Screening Levels for Groundwater.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l in two of the 10 locations sampled at a concentration of 0.0051 mg/l in NY-MW-9R and 0.0062 mg/l in NY-MW-11R.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l in two of the 10 locations sampled at a concentration of 0.401 mg/l in NY-MW-33R and 0.456 mg/l in NY-MW-55.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l in eight of the 10 locations sampled at concentrations ranging from 0.0020 mg/l in NY-MW-52 to 0.0274 mg/l in NY-MW-33R.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in four of the 10 locations sampled at concentrations ranging from 25.6 mg/l in NY-MW-55 to 60.5 mg/l in NY-MW-11R.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in all 10 of the locations sampled at concentrations ranging from 0.0913 mg/l in NY-MW-51 to 7.03 mg/l in NY-MW-33R.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-74**.

1.7.2.3.7 October 2018 Groundwater Sampling

Groundwater samples were collected from site wells located in the Maintenance Facility, including NY-MW-2, NY-MW-4, NY-MW-19, NY-MW-20, NY-MW-21, NY-MW-25, NY-MW-26, NY-MW-28, NY-MW-29, NY-MW-30 through NY-MW34 (not including NY-MW-33), and NY-MW-41, during the October 2018 groundwater sampling event. This sampling event was conducted to track the progress of the ERD injection pilot study.

Groundwater samples were analyzed for VOCs in order to determine the effectiveness of the sodium lactate solution addition with respect to cVOCs in site groundwater. The injections and additional monitoring and sampling related to this pilot test will be discussed further in Section 3.5.

Each sample was analyzed for VOCs by EPA method 8260 by Eurofins Lancaster Labs. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

<u>VOC Results</u>

During the October 2018 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Bromodichloromethane was detected above the DNREC-SIRS Screening Level for Groundwater of 0.13 ug/l at one of the 14 locations sampled at a concentration of 1 ug/l in NY-MW-20.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l at four of the 14 locations sampled at concentrations ranging from 1 ug/l in NY-MW-41 to 9 ug/l in NY-MW-20.

1,1-Dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 7 ug/l in three of the 14 locations sampled at concentrations ranging from 10 ug/l at NY-MW-30 to 53 ug/l in NY-MW-2.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l at eight of the 14 locations sampled at concentrations ranging from 88 ug/l in NY-MW-28 to 13,000 ug/l in NY-MW-2.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in eight of the 14 locations sampled at concentrations ranging from 42 ug/l in NY-MW-21 to 1,700 ug/l in NY-MW-31. The baseline groundwater sample collected at NY-MW-31 during the August 2018 sampling event was reported a TCE concentration of

69,000 ug/l indicating dechlorination of TCE. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Vinyl chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in seven of the 14 locations sampled at concentrations ranging from of 2 ug/l in NY-MW-28 to 1,100 ug/l in NY-MW-2. The baseline groundwater sample collected at NY-MW-2 during the July 2018 groundwater sampling event reported a vinyl chloride concentration of 190 ug/l indicating active dechlorination of TCE into degradation products including vinyl chloride. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-75**. VOC analytical results are summarized on **Figure 1-39**. Isoconcentration maps for TCE, cis-1,2-dichloroethene, and vinyl chloride are provided as **Figures 1-40**, **1-41**, and **1-42**, respectively. It should be noted that this sampling event targeted wells within the source area. Not all site wells were sampled during this event and Isoconcentration maps don't represent a full depiction of the extent of cVOCs in the subsurface.

1.7.2.3.8 February 2019 Groundwater Sampling

Groundwater samples were collected from all site wells located in the Maintenance Facility that didn't contain measurable LNAPL (NY-MW-17 and NY-MW-18), during the February 2019 groundwater sampling event. This sampling event was conducted to track the progress of the ERD in-situ groundwater treatment pilot test and document conditions prior to the ERD injections conducted in May 2019. Groundwater samples were collected for VOCs, TOC and select metals in order to determine the effectiveness of the sodium lactate solution addition with respect to cVOCs in site groundwater. The injections and additional monitoring and sampling related to this pilot test will be discussed further in Section 3.5.

At each well location, the groundwater was purged of three well volumes or until the well went dry using a submersible pump to ensure the collection of representative groundwater samples. During purging, field measurements of temperature, pH, specific conductance, redox potential, and dissolved oxygen were recorded (field parameter results are summarized on **Table 1-53**) and samples were collected after stabilization of the field measurements. Well purging and sampling equipment were decontaminated between each well. Each sample was analyzed for VOCs by EPA method 8260.

Groundwater samples were also collected for SVOCs by EPA method 8270C, total and filtered TAL-metals by EPA method 6020, PCBs by EPA method 8082 at newly installed monitoring wells NY-MW-56 and NY-MW-57. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

VOC Results

During the February 2019 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Benzene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.46 ug/l at NY-MW-30 at a concentration of 9 ug/l. Benzene had not been detected at this location during previous groundwater sampling events.

Chlorobenzene was detected above the DNREC-SIRS Screening level for Groundwater of 7.8 ug/l at a concentration of 9 ug/l at NY-MW-16 and 51 ug/l at NY-MW-8.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l at three of the 48 locations sampled at concentrations ranging from 1 ug/l in NY-MW-19 to 3 ug/l in NY-MW-20.

1,1-Dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 7 ug/l at NY-MW-31 at a concentration of 24 ug/l.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l at eight of the 48 locations sampled at concentrations ranging from 9 ug/l in NY-MW-15 to 6,600 ug/l in NY-MW-31.

Methylene chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 5 ug/l at NY-MW-31 at a concentration of 8 ug/l. Methylene chloride had not been detected at this location during previous groundwater sampling events.

Tetrachloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 1 ug/l at three of 48 wells sampled at concentrations ranging from 3 ug/l at NY-MW-6 to 11 ug/l at NY-MW-34.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in 11 of the 48 locations sampled at concentrations ranging from 2 ug/l in NY-MW-6 to 5,900 ug/l in NY-MW-31. The baseline groundwater sample collected at NY-MW-31 during the August 2018 sampling event was reported a TCE concentration of 69,000 ug/l indicating dechlorination of TCE. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in seven of the 48 locations sampled at concentrations ranging from 2 ug/l in NY-MW-28 to 620 ug/l in NY-MW-31. The baseline groundwater sample collected at NY-MW-2 during the July 2018 groundwater sampling event reported a vinyl chloride concentration of 190 ug/l indicating active dechlorination of TCE into degradation products including vinyl chloride. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-76**. VOC analytical results are summarized on **Figure 1-43**. Isoconcentration maps for TCE, cis-1,2-dichloroethene, and vinyl chloride are provided as **Figures 1-44**, **1-45**, and **1-46**, respectively.

PCB Aroclor Results – Unfiltered Samples

Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Groundwater for Aroclor 1260 of 0.0078 ug/l in NY-MW-56 at a concentration of 0.042 ug/l. Concentrations of total PCBs were not detected above the DNREC-SIRS Screening Level for Groundwater of 0.044 ug/l during this sampling event. PCB analytical results are provided on **Table 1-77**. Monitoring well locations are depicted on **Figure 1-17**. PCB analytical results are depicted on **Figure 1-30**.

PCB Aroclor Results – Filtered Samples

There were no detections of PCB Aroclors in either filtered sample collected from NY-MW-56 or NY-MW-57 during the February 2019 sampling event. PCB analytical results are provided on **Table 1-77**. Monitoring well locations are depicted on **Figure 1-17**. PCB analytical results are depicted on **Figure 1-30**.

SVOC Results

During the February 2019 sampling event, groundwater samples were collected from NY-MW-56 and NY-MW-57 and analyzed for SVOCs. There were no SVOCs detected at NY-MW-56 or NY-MW-57 during this sampling event.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-78**.

TAL – Metals Results – Total Samples

During the February 2019 sampling event, groundwater from NY-MW-56 and NY-MW-57 was sampled for total TAL-metals. Total and filtered iron, sodium, arsenic, and manganese was analyzed for all wells sampled during the February 2019 sampling event. The following total TAL-metals were detected above the DNREC-SIRS Screening Levels in groundwater.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l in 15 of the 48 locations sampled at concentrations ranging from 0.0023 mg/l in NY-MW-33R to 0.0156 mg/l in NY-MW-10.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l in NY-MW-56 at a concentration of 0.570 mg/l in NY-MW-56.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l at concentrations of 0.0323 mg/l in NY-MW-56 and 0.0357 mg/l in NY-MW-57.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in 33 of the 48 locations sampled at concentrations ranging from 2.46 mg/l in NY-MW-36 to 70.2 mg/l in NY-MW-26.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in 41 of the 48 locations sampled at concentrations ranging from 0.0967 mg/l in NY-MW-51 to 9.83 mg/l in NY-MW-26.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-79**.

TAL – Metals Results – Filtered Samples

During the February 2019 sampling event, groundwater was sampled for filtered metals by passing the sample through a 0.45-micron filter in the field and analyzing for TAL-metals. Monitoring wells NY-MW-56 and NY-MW-57 were analyzed for all TAL-metals. Other monitoring wells sampled during this event were analyzed for iron, arsenic, sodium, manganese and TOC. The following constituents were detected above the DNREC-SIRS Screening Level for Groundwater.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l in 12 of the 48 locations sampled at a concentration of 0.0020 mg/l in NY-MW-46 to 0.0129 mg/l in NY-MW-2.

Barium was detected above the DNREC-SIRS Screening Level for Groundwater of 0.38 mg/l in filtered samples collected at NY-MW-56 at a concentration of 0.569 mg/l.

Cobalt was detected above the DNREC-SIRS Screening Level for Groundwater of 0.0006 mg/l in NY-MW-56 and NY-57 at concentrations of 0.0329 mg/l and 0.0357 mg/l, respectively.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in 28 of the 48 locations sampled at concentrations ranging from 2.39 mg/l in NY-MW-9R to 70 mg/l in NY-MW-26.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in 40 of the 48 locations sampled at concentrations ranging from 0.102 mg/l in NY-MW-51 to 10.6 mg/l in NY-MW-26.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-79**.

1.7.2.3.9 June 2019 Groundwater Sampling

Groundwater samples were collected from Site wells located in the Maintenance Facility, including NY-MW-2, NY-MW-3, NY-MW-19, NY-MW-20, NY-MW-21, NY-MW-25, NY-MW-26, NY-MW-28, NY-MW-29, NY-MW-30 through NY-MW34 (not including NY-MW-33), NY-MW-40 and NY-MW-41, during the June 2019 groundwater sampling event. This sampling event was conducted to track the progress of the ERD injections conducted in May 2019. Groundwater samples were collected for VOCs, TOC and select metals in order to determine the effectiveness of the sodium lactate solution addition with respect to cVOCs in site groundwater. The injections and additional monitoring and sampling related to this pilot test will be discussed further in Section 3.5.

At each well location, the groundwater was purged of three well volumes or until the well went dry using a submersible pump to ensure the collection of representative groundwater samples. During purging, field measurements of temperature, pH, specific conductance, redox potential, and dissolved oxygen were recorded (field parameter results are summarized on **Table 1-53**) and samples were collected after stabilization of the field measurements. Well purging and sampling equipment were decontaminated between each well. Each sample was analyzed for VOCs by EPA method 8260. The groundwater laboratory analytical data packages and data validation reports are provided in **Appendix 1-8**.

<u>VOC Results</u>

During the June 2019 sampling event, groundwater samples analyzed for VOCs were compared to the DNREC-SIRS Screening Levels for Groundwater. The results are summarized below.

Chloroform was detected above the DNREC-SIRS Screening Level for Groundwater of 0.22 ug/l at three of the 15 locations sampled at concentrations ranging from 1 ug/l in NY-MW-19 to 2 ug/l in NY-MW-25 and NY-MW-41.

Cis-1,2-dichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 3.6 ug/l at eight of the 15 locations sampled at concentrations ranging from 4 ug/l in NY-MW-40 to 2,300 ug/l in NY-MW-2.

Trichloroethene was detected above the DNREC-SIRS Screening Level for Groundwater of 0.28 ug/l in three of the 15 locations sampled at concentrations ranging from 150 ug/l in NY-MW-21 to 680 ug/l in NY-MW-28. The baseline groundwater sample collected at NY-MW-31 during the August 2018 sampling event was reported a TCE concentration of 69,000 ug/l indicating dechlorination of TCE. TCE was not detected in monitoring well NY-MW-31 during the June 2019 sampling event. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Vinyl Chloride was detected above the DNREC-SIRS Screening Level for Groundwater of 0.019 ug/l in seven of the 15 locations sampled at concentrations ranging from of 1 ug/l in NY-MW-21 to 1,300 ug/l in NY-MW-2. The baseline groundwater sample collected at NY-MW-2 during the July 2018 groundwater sampling event reported a vinyl chloride concentration of 190 ug/l indicating active dechlorination of TCE into degradation products including vinyl chloride. As will be discussed in Section 3.5, additional groundwater sampling will be conducted to track the progress of the ERD in-situ groundwater treatment pilot test.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-80**. VOC analytical results are summarized on **Figure 1-47**. Isoconcentration maps for TCE, cis-1,2-dichloroethene, and vinyl chloride are provided as **Figures 1-48**, **1-49**, and **1-50**, respectively. It should be noted that this sampling event targeted wells within the source area. Not all site wells were sampled during this event and does not represent a full depiction of the extent of cVOCs in the subsurface.

<u>TAL – Metals Results – Filtered Samples</u>

During the June 2019 sampling event, groundwater was sampled for filtered metals by passing the sample through a 0.45-micron filter in the field and analyzing for TAL-metals. Monitoring wells NY-MW2, NY-MW-3, NY-MW-19, NY-MW-20, NY-MW-21, NY-MW-25, NY-MW-26, NY-MW-28, NY-MW-29, NY-MW-30, NY-MW-31, NY-MW-32, NY-MW-33R, NY-MW-40, and NY-MW-41 were analyzed for iron, arsenic, sodium, manganese and TOC. The following constituents were detected above the DNREC-SIRS Screening Levels for Groundwater.

Arsenic was detected above the DNREC-SIRS Screening Level for Groundwater of 0.000052 mg/l in 7 of 15 locations sampled at concentrations ranging from 0.0023 mg/l in NY-MW-33R to 0.0400 mg/l in NY-MW-26.

Iron was detected above the DNREC-SIRS Screening Level for Groundwater of 1.4 mg/l in nine of the 15 locations sampled at concentrations ranging from 8.84 mg/l in NY-MW-20 to 177 mg/l in NY-MW-2.

Manganese was detected above the DNREC-SIRS Screening Level for Groundwater of 0.043 mg/l in 12 of the 15 locations sampled at concentrations ranging from 0.0636 mg/l in NY-MW-40 to 7.72 mg/l in NY-MW-26.

Monitoring well locations are depicted on **Figure 1-17**. Laboratory analytical results are summarized on **Table 1-81**.

1.7.3 Sediment Investigations

Soil and sediment sampling were conducted in transects across the drainage ditch north of Outfall 002 as well as the NED. The NED is located northeast of the Maintenance Facility.

Sampling in the drainage ditch north of Outfall 002 was conducted across two transects ("A" and "B" transects). Samples were collected in the center of the ditch as well as top of slope and bottom of slope on either side of the ditch. Soil samples were collected from 0-0.3 ft bgs ("A" interval) 0.3-3.3 ft bgs ("B" interval) and in three-foot intervals or until the clay layer was encountered. Soil and sediment analytical results were summarized in the IDS Report. Transect sample locations are depicted on **Figure 1-51**.

Based on this sampling event, additional bank soil samples were collected for PCB Aroclor analyses for further delineation of PCBs at 002-B-V(0-0.3) where 54 mg/kg total PCBs were detected. Bank soil samples were collected to the north, south, east and west of 002-B-V using a hand auger from the "A" interval (0 to 3 inches bgs). Bank soil samples were analyzed for PCB Aroclors (Method 8082) by Eurofins Lancaster Labs.

Laboratory analytical data reports and data validation reports are provided in **Appendix 1-9**.

<u>Outfall 002 Drainage Ditch Investigation PCB Results</u>

Soil samples were collected to the north, south, east and west of previous soil boring location 002-B-V(0-0.3) and analyzed for PCB Aroclors by EPA method 8082. PCB Aroclor results were compared to the DNREC-SIRS Screening Levels for Soil.

PCB Aroclor 1254 was detected above the DNREC-SIRS Screening Level for Soil of 0.12 mg/kg in three of the five samples collected at concentrations ranging from 3.2 mg/kg at 002-B-V(0.0-0.3)D to 4.4 mg/kg at 002-B-V(0.0-0.3)A.

PCB Aroclor 1260 was detected above the DNREC-SIRS Screening Level for Soil of 0.24 mg/kg in all of the five samples collected at concentrations ranging from 2.2 mg/kg at 002-B-V(0.0-0.3)C to 51 mg/kg at 002-B-V(0.0-0.3)B.

Total PCB Aroclors were detected above the DNREC-SIRS Screening Level for Soil of 0.23 mg/kg in all of the five samples collected at concentrations ranging from 5.8mg/kg at 002-B-V(0.0-0.3)C to 51 mg/kg at 002-B-V(0.0-0.3)B.

Soil sample 002-B-V(0.0-0.3)E was collected approximately 10 ft. to the east of 002-B-V(0.0-0.3) in order to characterize the concentrations of PCBs at this location. Soil sample locations are depicted on **Figure 1-51**. Analytical results are provided on **Table 1-82**.

<u>Additional Sediment Investigations PCB Aroclor Results</u>

Three locations in the vicinity of NED-26 (0-0.25) (where 1,100 mg/kg PCBs were detected) were sampled for PCB analyses. Sediment samples were collected from the "A" horizon (0 to 3 inches below the sediments surface) at the original location of NED-26 and 25 feet upstream and downstream of that location. Samples were collected for PCB Aroclor analyses (Method 8082).

PCB Aroclors were detected above the DNREC SIRS Screening Level for Sediment Fresh water in all three samples analyzed at concentrations ranging from 3.0 mg/kg at NED-26S to 7.6 mg/kg at NED-26_20161003. PCB Aroclor analytical results are provided on **Table 1-83**. The PCB Aroclor result previously identified at this location was not replicated. Total PCB Aroclors were identified at a concentration of 7.6 mg/kg. Total PCB Aroclor analytical results are provided on **Figure 1-51**. Laboratory analytical data reports and data validation reports are provided in **Appendix 1-9**.

<u>Additional Sediment Investigations VOC Results</u>

Samples were collected at the location of NED-23 (0 to 0.25) (where 110 mg/kg of chlorobenzene was detected) for VOC analyses. Sediment samples were collected from the "A" horizon (0 to 3 inches below the sediments surface) at the original location of NED-23 and 25 feet upstream and downstream of that location. Sediment sample locations are depicted on **Figure 1-51**. Samples were collected for VOC analyses (method 8260B).

Chlorobenzene was detected above the DNREC-SIRS Screening Level for Ecological Fresh Water of 0.00842 mg/kg in sediment samples NED-23_20161003 at a concentration of 1.1 mg/kg and NED-23S at a concentration of 0.48 mg/kg. The chlorobenzene concentration previously identified at NED-23 was not replicated during this event. VOC analytical results are provided on **Table 1-84**. Laboratory analytical data reports and data validation reports are provided in **Appendix 1-9**.

1.7.4 Surface Water Investigations

Surface water sampling was previously discussed in the IDS Report and summarized in Section 1.6. Based on the results of surface water sampling conducted as part of this RI, there was no additional surface water sampling proposed.

Surface water data collected by Amtrak as part of the NPDES monitoring program at the Facility is evaluated on an ongoing basis. The current NPDES permit (DE0050962) became effective September 1, 2017. The current permit is effective through August 31, 2022. Outfall 002 collects surface water runoff from the area identified in **Figure 1-4** identified in the current NPDES permit and monitored in accordance with the permit. The Outfall 007 drainage area was addressed in the RSFFS for the Former Fueling Facility.

The monitoring requirements of the current NPDES permit vary by outfall location and are included in **Appendix 1-3**. Parameters for analysis at Outfall 002 under the permit include oil and grease, pH, TCE, surfactants, and PCB congeners. The new permit also requires annual dry weather as well as wet weather PCB congener analyses from Outfall 002.

A summary of the NPDES monitoring results for those outfalls adjacent to the Maintenance Facility are included in the discharge monitoring reports submitted to DNREC. **Table 1-83** includes a summary of PCB congener results for dry weather and wet weather sampling events at Outfall 002 through 2018.

1.8 Interim Remedial Measures

Interim remedial measures (IRMs) were implemented within and adjacent to the Administration Building (Building 12) in response to the detection of cVOCs (primarily TCE) in sump water, groundwater, soil and indoor air. The following is a summary of the IRMs implemented. Operation, maintenance and monitoring of these measures is ongoing.

1.8.1 Basement Sump Water Treatment System

As described in the Revised WMF RI/FFS Work Plan, TCE was detected in certain basement dewatering sumps. Beginning in 2011, sumps in which TCE was detected were connected to a water treatment system. The capacity of the system was subsequently upgraded such that all sumps (except one) are now connected to the water treatment system. Refer to **Figure 1-52** for basement sump locations.

The water treatment system consists of routing water from all basement sumps (except Sump-6 at the bottom of the basement entrance ramp which also collects storm water) to an equalization tank located in the basement. A transfer pump, operating on tank water level probes, pumps the water through a bag filter assembly. The water flow is then split through two sets of three approximately 200-pound granular activated carbon (GAC) vessels. Groundwater samples are collected on a regular basis (generally one to two months; depending on flow rates) before, between and after the GAC units in order to determine when replacement of the GAC is needed. The treated water is discharged to the Outfall 002 storm water sewer system under the NPDES permit (DE0050962).

1.8.2 Basement Interim Remedial Measures

Historically, TCE has been detected at Outfall 002 during annual NPDES sampling. A video inspection of the Outfall 002 stormwater conveyance indicated that sump water is pumped from the Administration Building basement to a storm sewer along the west side of the building, ultimately discharging to Outfall 002. As described in the Revised WMF RI/FFS Work Plan and in the March 2015 Interim Data Submittal, TCE was reported in Administration Building basement dewatering sumps. In order to minimize the contribution of TCE to Outfall 002, water from Sumps 1, 2, and 3 were connected to a granulated activated carbon (GAC) treatment system on October 5, 2011. Subsequently, all basement sumps (except Sump-6 at the bottom of the basement entrance ramp which also collects storm water) were connected to the basement water treatment system. The wet and dry weather monitoring for TCE at Outfall 002 is included in the NPDES permit (Permit #DE0050962) for the facility (the NPDES permit is included in **Appendix 1-3**).

Monitoring of the water treatment system showed that although TCE and other VOCs were removed from the effluent of the Administration Building basement dewatering system discharge, TCE was still detected at Outfall 002. Since TCE was not detected in the effluent from the basement sump water treatment system but was detected at Outfall 002, track-back investigations were performed to identify locations of potential inputs to the storm sewer system. As described in the IDS Report, a dry weather track-back investigation of the Outfall 002 drainage system was conducted on October 1, 2013 (the TCE track-back investigation results are attached as **Appendix 1-11**). Preferential groundwater movement along the sewer system and groundwater seepage into the storm sewer system is believed to be the primary source of TCE in the storm sewer system.

The following IRMs were implemented in the basement of the Administration Building in order to address the potential occurrence of cVOCs in indoor air:

- Installation of a vapor barrier along the eastern wall of the basement. In order to address potential vapor concerns with cracks and pipe penetrations through the brick and mortar wall and from standing water in a perimeter trough (which drains to a sump), a wall constructed of 15 mil StegoCrawl™ Wrap vapor abatement fabric was installed along the east wall of the basement from near the north end extending approximately 195 feet south. The wall was fastened to the existing foundation just below the ceiling crossbeams and to the floor on the opposite side of the trough. Sections of the material were bonded together with StegoCrawl™ Tape. Also, slotted piping was installed within the interstitial space between the vapor abatement fabric and the existing foundation for ventilation. Air ventilated from the interstitial space is routed through piping and passed through GAC described below.

- Placement and operation of seven blowers that route ambient basement air through GAC vessels and discharge conditioned air into the basement. Each blower is connected to slotted pipe intakes that route air through a 55-gallon GAC vessel. The effluent of the GAC vessel is monitored with a low detection level PID; no VOCs have been detected in the effluent during maintenance of these vessels,

- A decommissioned elevator shaft pit was sealed with concrete along with other floor and wall openings,

- The staircase on the north end of the Administration Building basement was encased with walls. A door with a gasket was installed to further mitigate potential migration of basement air to the first floor.

- Installation of sliding glass doors on the first and second floors in the central stairway. This set of sliding glass doors were installed to separate air movement through the building's central staircase from the 1st and 2nd floors in advance of the installation of the First-Floor Pressurization System (described below).

1.8.2.1 Subsurface Depressurization System Along the East Wall of the Administration Building

As described in the Interim RI Data Submittal, a subsurface depressurization system was installed adjacent to the east side of the Administration Building foundation (within five feet of the building) in order to develop a negative soil vapor pressure gradient (relative to local, subsurface air in the vicinity of the Administration Building basement). This subsurface vapor extraction application is intended to provide negative soil vapor pressure in order to capture potential vapors in the vicinity of the basement foundation. The system operates using a low applied vacuum (air flow is lower than would typically be used for SVE systems designed for VOC mass removal). The installation of the system was coordinated with the removal and subsequent reconstruction of the loading dock/platform along the east side of building such that the vapor extraction points are now located beneath the loading dock.

The subsurface depressurization system includes 12 vertical 2-inch diameter extraction points installed beneath the current loading dock along the Administration Building east wall, to a depth of approximately 15 feet (drilling records for these points are included in **Appendix 1-5**). Each point is piped individually to a 1.5 Hp Blower located in a small shed adjacent to Building 13 (a layout of the system is included on **Figure 1-53)**. The layout of the system was developed from field pilot testing to confirm influence between extraction points and to assess potential VOC emissions. Based on discussions with DNREC Department of Air Quality (DAQ) and the estimated VOC emission rate (< 0.2 lb./day), a DNREC air emission permit was not required. The registration package for this system was submitted to DNREC DAQ and is included in **Appendix 1-10.**

1.8.2.2 First Floor Pressurization System

During 2016 and early 2017, HVAC equipment was installed to apply a slight pressure to the first floor of the building. The pressurization system was designed to create a positive pressure on the upper floors, primarily the first floor relative to the basement. This IRM included the installation of two air handling units in the basement. These units route outside tempered air to the first floor through new duct work (in the basement) to the first-floor registers. An exhaust fan was also installed in the basement. Based on pressure data collected between the first floor and basement, this mitigation measure has created and maintained a higher pressure on the first floor in relation to the basement. **Figure 1-54** displays pressure differential between the 1st floor relative to the basement for the period January through August 2017 and indicates that a positive pressure was maintained in the 1st floor relative to the basement. The system was installed and operational prior to the March 2017 indoor air sampling event.

1.8.2.3 Operation, Maintenance and Monitoring of Interim Remedial Measures

In order to verify the continued effectiveness of the IRMs described above, routine operation, maintenance, and monitoring (OM&M) activities are performed. OM&M activities include:

- OM&M of the basement water treatment system. As mentioned above, water samples are collected throughout the water treatment system in order to determine the need for replacement of the GAC,

- The effluent from the seven basement air recirculation units is monitored with a low detection level PID (parts per billion detection capabilities) to determine the need for replacement of the GAC,
- Flow rates and PID measurements are recorded from each individual vapor withdrawal point of the subsurface depressurization system and from the effluent of the entire system,
- Automated data logging equipment has been installed to verify that the first-floor pressurization system maintains a positive air pressure differential in the first floor relative to the basement, and
- Periodic indoor air sampling will be performed at the 11 locations historically sampled within the Administration Building.

1.8.2.4 Site Media Investigations Related to the Administration Building

As part of the investigation of cVOCs, Site media including soil, groundwater, surface water, and indoor air was sampled and analyzed for constituents related to TCE. The Site soil and groundwater investigations were summarized in the IDS Report as well as Section 1.7.

Indoor air sampling was conducted within the Administration Building as well as buildings within the proximity of locations identified with TCE concentrations in groundwater. A summary of indoor air sampling was provided to DNREC in the *Field-scale Pilot Testing – Enhanced Reductive Dechlorination* report dated April 9, 2018 (refer to **Appendix 1-1**). Additional indoor air samples were collected as part of the monitoring program. Historical indoor air analytical results are summarized on **Table 1-84**.

Indoor air samples were collected within the Administration Building during September 2015, March 2016, April 2016, March 2017, January 2018, August 2018, December 2018, March 2019 and July 2019. For each sampling event, a pre-sampling inventory was completed in accordance with the DNREC *Policy concerning the investigation, risk determination and remediation for the Vapor Intrusion pathway*, March 2007, DNREC-SIRS Standard Operating Procedure for Indoor Air Sampling, and consistent with *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to indoor Air* (USEPA Office of Solid Waste and Emergency Response, June 2015). The completed Indoor Air Building Survey pre-sampling inventory forms are included in **Appendix 1-12**.

During each sampling event, indoor air samples were collected from Summa canisters (with a targeted air intake time of 8 hours for each sample) deployed at up to 11 locations (four on the 2nd floor, four in the 1st floor, two in the basement and one ambient/background location outside the building). Some sample events targeted only indoor air in the basement of the Administration Building. Administration Building indoor air sampling locations are depicted on **Figure 1-52**. At the end of the draw period, the samples were sent to Eurofins Lancaster Laboratories (Lancaster Labs) and analyzed for VOCs detected in the basement sump water (TCE, PCE, cis-1,2 DCE, vinyl chloride and chloroform) by method TO+15. The indoor air samples were collected during normal working hours with the exception of the September 2015 sampling event which was conducted on a weekend.

The analytical data from indoor air sampling events are summarized on **Table 1-84**. Laboratory analytical data is included in **Appendix 1-13.**

1.8.2.5 Vapor Intrusion Investigation Related to Other Buildings

In accordance with the DNREC *Policy concerning the investigation, risk determination and remediation for the Vapor Intrusion pathway*, March 2007, potential vapor intrusion into other occupied buildings was investigated. The DNREC 2007 vapor intrusion policy requires investigation of any building within 100 feet of a groundwater TCE plume with groundwater concentrations of 5 ug/l. Based on the extent and magnitude of the TCE plume, a total of 15 buildings at the Wilmington Shops site were evaluated during this assessment. These buildings are the Roadway Equipment Car Shop (Building 2), the Locomotive Shop (Building 3), the Electric Shop (Building 4), the Card Room (Building 5), the Bake Shop (Building 6), the Maintenance Shop (Building 8), the Administration Building (Building 12), the Metal Storage (Building 13), the Midway Locker Room (Building 14), the Material Control Foreman Locker Room (Building 15), the Blacksmith/Brake Shop (Building 16), the Power House (Building 17), the Paint Shop (Building 18), the Waste Oil Storage (Building 24), and the Hazard Waste Drum Storage (Building 39). The results of the building preliminary investigations including assessment of general building construction, building operations, a PID survey and sampling of standing water in basement or sump locations were included in the ERD Pilot Test Work Plan (refer to **Appendix 1-1**).

Indoor air sampling was conducted at locations depicted on **Figure 1-55**. Laboratory analytical results are summarized on **Table 1-84**. Samples were analyzed for VOCs detected in groundwater in the general area (TCE, PCE, chloroform, cis-1,2-DCE, and vinyl chloride). No VOC was detected during sampling of other buildings at the Facility.

1.8.3 PCB Minimization Measures

Amtrak submitted a Pollution Minimization Plan (PMP) dated September 28, 2005 in order to address known or probable sources of PCBs entering the Delaware estuary. PMP Annual Reports are submitted to DNREC and the Delaware River Basin Commission (DRBC). An updated PMP Report was submitted on August 30, 2018 and is included in **Appendix 1-1**.

The PMP Annual reports summarize efforts to prevent the potential migration of sediments and LNAPL with PCBs to surface water. As such, Amtrak and APU have documented activities to prevent this migration including:

- Inlet protection pilot study,
- Stormwater and industrial waste sewer cleaning and video inspections,
- LNAPL monitoring and recovery,
- Erosion and sedimentation control measures,
- Soil removal through excavation for infrastructure upgrades, and
- Monitoring for PCBs in surface water through the NPDES permit and PMP program.

Baseline loading of PCBs from the Maintenance Facility was reported in the PMP Annual Report and was estimated using data from Outfall 002 (using the 2005 sampling program data), Outfall 007 (using one sample collected during 2006 and two samples collected in 2007), and the wastewater treatment system (using 2006 data collected in accordance with the City of Wilmington discharge permit). The PMP Annual reports have documented the removal of approximately 4,800 lbs. of PCBs through the various minimization programs. As reported in the PMP Annual Report for 2018, loading of PCBs to the Delaware estuary was estimated to have decreased by approximately 92.6% from baseline conditions.

PCB monitoring and minimization measures will continue as part of the NPDES permit (DE0050962) for the Facility.

1.8.4 Manhole 14 Area Pre-emptive Measures

As discussed in Section 1.7, in an effort to prevent the migration of LNAPL from entering the storm sewer system in the area of Manhole 14, a 50-foot section of piping from MH-14 to the upgradient manhole was replaced with a solid section of HDPE pipe. **Figure 1-28** depicts the location of MH-14.

Based on the presence of LNAPL identified in the stormwater conveyance, a video inspection was conducted in the MH-14 area in order to identify any location of LNAPL infiltration. A section of piping upgradient of MH-14 displayed longitudinal cracking extending outward from where a roof drain was tapped into the piping. Staining from LNAPL was observed at this location indicating this as the source of LNAPL in the stormwater conveyance.

With the installation of the HDPE piping, a trench was also excavated below the pipe and filled with pea gravel to accommodate collection of LNAPL. Standpipes were installed in the gravel to monitor the accumulation of LNAPL in this area. Since the installation of the piping, there has been no observed LNAPL in the MH-14 area stormwater conveyance or the standpipes installed in the area. The MH-14 area pre-emptive measures including laboratory analytical data is summarized in Section 1.7.

1.9 Nature and Extent of Contamination

Environmental samples were collected from Site soil, groundwater, sediments, and surface water in the Maintenance Facility (DE-0170). LNAPL samples were also collected from site piezometers and monitoring wells. Samples were collected during the RI (as well as investigations prior to the RI), infrastructure projects, PMP activities (including excavations and track-back investigations), and supplemental remedial investigations.

The Focused Feasibility Study (FFS) presented in Sections 2 through 6 of this Report analyzes remedial alternatives for the soil and sediment in the Outfall 002 drainage area (**Figure 1-8**). Groundwater in the Outfall 002 and Outfall 007 drainage areas is addressed in this FFS. Remedial alternatives presented in the RSFFS and subsequent RSFFS Addendums for the Former Fueling Facility (DE-0266) addressed soil and sediment in the Outfall 007 drainage area.

1.9.1 Outfall 002 Drainage Area Soils

Investigations related to Site soils in the Outfall 002 drainage area were summarized in Section 1.7 as well as the 2015 IDS, included in **Appendix 1-1**. Site soils have been characterized extensively for PCBs as well as TCL/TAL compounds. As previously discussed, soil within the Outfall 007 drainage area is addressed in the RSFFS and Addendums for the Former Fueling Facility (DE-0266)

Supplemental soil investigations include sampling related to Self-Implementing PCB remediation and post-excavation sampling in accordance with 40 CFR 761.61(a). Within the Outfall 002 drainage area three Self-Implementing PCB Notifications were submitted to and approved by the USEPA: Wreck Track Improvement Project, Building 15.1 Equipment Enclosure, and the Transfer Table Extension Project. The Transfer Table Extension Project has not been completed as of the time of this Report; however, the finished project will be within the Outfall 002 drainage area. The data collected as part of these characterization and post-excavation sampling events were presented in Section 1.7.

Based on the results of characterization sampling, and as will be described in the human health risk assessment, several constituents have been identified above the DNREC-SIRS Screening Level for Soil.

- A summary of PCB concentrations in soil is presented on **Figures 1-16a** through **1-**

16e.

- SVOCs and TAL-metals were identified above the DNREC-SIRS Screening Level for Soil but are not considered Constituents of Potential Concern (COPCs).
- VOCs, including TCE and TCE degradation products such as cis-1,2-DCE were detected above the DNREC-SIRS Screening Level for Soil. A summary of TCE concentrations detected above the DNREC-SIRS Screening Level in Soil is presented on **Figure 1-56**.

Soil analytical results are used in the HHRA and presented in Section 1.11. COPCs are presented and summarized in the HHRA. Soils with COPCs will be addressed as described in the FFS presented in Sections 2 through 6.

1.9.2 Outfall 002 Drainage Ditch and NED Sediments

Sediment samples were collected from the drainage ditch north of Outfall 002. Sampling was conducted along two transects (A and B). Soil samples were collected at the top of slope and bottom of slope adjacent to the drainage ditch. One sample location was collected in the center of the ditch along each transect. Drainage Ditch sediment sample results are depicted on **Figure 1-16a** through **1-16e.** Within the center of the Outfall 002 drainage ditch samples were collected from the upper three inches of sediment ("A" interval). Samples were planned to be collected in three-foot horizons from three inches into the sediment to the top of the clay substrate ("B" interval) and from the clay substrate ("C" interval); however, a solid substrate was encountered consistently from the Outfall to the confluence with the Shellpot Creek. **Figure 1-11** shows an excavation as proposed in 1982 in this area. It is assumed that there was a concrete base placed at the bottom of the ditch.

Total PCB Aroclor concentrations in Site sediments were detected at concentrations of 17.3 mg/kg at 002-A-III(0.0-0.3) and 3.9 mg/kg at 002-B-III(0.0-0.3). TCE was detected above the DNREC-SIRS Screening Level - Freshwater Sediment at 002-A-III(0.0-0.3). Sediment within the Outfall 002 drainage ditch will be addressed in the FFS.

Bank soils (top of bank and bottom of bank) along each transect will be addressed with Site soils as described in the focused feasibility study presented in Sections 2 through 6.

Additional sediment investigations in the upper NED were conducted where PCBs were identified at NED-26(0-0.25) at a concentration of 1,100 mg/kg. A verification sample collected at this location identified PCBs at a concentration of 7.6 mg/kg.

Additional sediment investigations in the upper NED were also conducted at NED-23(0-0.25) where chlorobenzene was identified at a concentration of 110 mg/kg. A verification sample collected at this location identified PCBs at a concentration of 1.1

mg/kg. Sediment within the upper NED will be addressed in the FFS.

1.9.3 Outfall 002 Drainage Area Surface Water

Surface water is monitored in accordance with the NPDES permit (Permit #DE0050962). As part of the monitoring for the NPDES Permit, dry weather and wet weather PCB congeners samples are collected on an annual basis along with quarterly monitoring for wet and dry weather TCE, semi-annual wet weather sampling for TSS, oil and grease, and surfactants.

Dry weather and wet weather surface water samples collected from Outfall 002 for PCB congener analyses are summarized in **Table 1-83**. The dry weather and storm water total PCB congener concentrations for samples collected at Outfall 002 (discharging to the Shellpot Creek) ranged from 24,163.29 pg/l (0.024 ug/l) on October 28, 2014 to 1,156,461.49 pg/l (1.156 ug/l) on October 7, 2005. A sample collected from water coming onto the site through Outfall 002 as a result of tidal backflushing during dry weather reported concentrations up to 1,187,000 pg/l (1.187 ug/l) total PCB congeners. The average dry weather outgoing tide PCB congener concentration at Outfall 002 is 65,625.453 pg/l (0.0656 ug/l). The average wet weather outgoing tide PCB concentration is 434,501.20 pg/l (0.4347 ug/l).

Concentrations of PCBs in surface water are due to the entrainment of suspended solids in surface water runoff. The FFS presented in Sections 2 through 6 describe management of surface water runoff and erosion controls to address potential migration of soil containing PCBs to the storm water conveyance and the discharge to surface water.

1.9.4 Groundwater

Groundwater investigations were summarized in Section 1.7. Occurrences of LNAPL and TCE in groundwater are summarized in Section 1.7. Routine groundwater gauging is conducted to document LNAPL in site monitoring wells. Additional inspections and O&M activities are conducted in order to verify migration of LNAPL is not occurring.

Other constituents including PCBs, SVOCs and TAL-metals were identified in groundwater; however, these constituents are generally immobile and/or only reported sporadically across the Site in groundwater. Concentrations of SVOCs and TAL-Metals were detected sporadically across the Site monitoring wells and are likely related to the entrainment of suspended solids in groundwater samples rather than dissolved phase migration of groundwater.

Groundwater is not used as drinking water at the Site or in the surrounding areas. The Facility is located within the City of Wilmington Groundwater Management Zone (GMZ) established in the "Amended Memorandum of Agreement between Delaware Division of Waste and Hazardous Substances and Delaware Division of Water. A copy of the Amended GMZ document is provided in **Appendix 1-14**. PCBs are monitored in surface water discharge as part of the NPDES permit for the Facility (DE0050962).

Below is a summary of TCE and LNAPL occurrences in groundwater.

1.9.4.1 TCE in Groundwater

Concentrations of TCE and related constituents in groundwater are summarized in Section 1.7. Isoconcentration maps for TCE, cis-1,2-DCE and vinyl chloride are provided for groundwater sampling events in April 2018, July 2018, October 2018, February 2019, and June 2019. As indicated, the highest TCE concentrations are located to the east of the Administration Building and west of and partially below the Locomotive Shop. TCE in this area is associated with historical operations (refer to **Figures 1-31**, **1-35**, **1-39**, **1-40**, **1-43**, and **1-47**, respectively).

An enhanced reductive dechlorination (ERD) pilot test was conducted in the area of the former degreaser and TCE AST located adjacent to the Administration Building. Two ERD events were conducted in August 2018 and May 2019. A discussion of the ERD Pilot Test is summarized in Section 3.5.

The lateral extent of TCE and dechlorination products in groundwater has been characterized. As depicted on the Isoconcentration maps from April 2018 through June 2019, TCE concentrations have been significantly decreased by the implementation of the ERD Pilot Test. Additional monitoring activities will be conducted as will be discussed in the FFS.

Monitoring well, NY-MW-4 was installed in the approximate location of the former TCE AST. The well was screened below the confining unit consisting of marsh deposit silt, clay and peat. Groundwater gauging data has identified an upward potentiometric head in relation to the unconfined groundwater above the marsh deposits. Due to the presence of the confining layer and the upward potentiometric head, there is limited downward mobility of TCE to the confined aquifer at the Facility. Monitoring related to the ERD Pilot Test has documented that no TCE, cis-1,2-DCE, or vinyl chloride was detected in NY-MW-4 in the February 2019sampling event. Concentrations of TCE and related compounds will be monitored, and additional sodium lactate injections will be conducted as necessary based on observed conditions.

1.9.4.2 LNAPL

LNAPL was identified in several locations across the Facility through routine gauging of monitoring wells and excavation for the completion of infrastructure projects. These areas include:

- MH-14 Area
- Pit 17 Area at Building 7
- NY-MW-1 Area
- Locomotive Yard

As will be discussed below, LNAPL occurrence in the Pit 17 Area at Building 7, NY-MW-1 Area and Locomotive Yard appear to be localized. LNAPL in the MH-14 area was evaluated through the development of a LNAPL Conceptual Site Model (refer to Section 3.3.3.1).

1.9.4.2.1 MH-14 Area LNAPL

LNAPL has been detected in the MH-14 area in the vicinity of the Locomotive Shop and Wheel Shop in the Maintenance Facility. The potential infiltration of this LNAPL to the storm water system was addressed through replacement of a section of piping upgradient from MH-14. This area continues to be monitored during routine O&M. The long-term management of this LNAPL in the vicinity of the Locomotive Shop and Wheel Shop is addressed in the LNAPL Conceptual Site Model summary in **Section 3.3.3.1.**

As previously mentioned, a section of the storm sewer piping was replaced with high density polyethylene (HDPE) piping upgradient of MH-14 where LNAPL was observed infiltrating at a crack. Additional video inspection was conducted in the area after the installation of this HDPE pipe documenting no infiltration of LNAPL. Additional monitoring of this piping will be conducted periodically, and maintenance performed as needed to prevent the infiltration of LNAPL into the storm sewer system.

The source of the LNAPL in this area is suspected to be a former AST with underground piping that fed the Wheel Shop. The AST had previously been removed from the Site. Additionally, a UST was located at the southwest corner of Building 16. This UST was reported to have formerly contained No. 2 oil. The extent of LNAPL in the subsurface in the area of MH-14 is characterized laterally as depicted on **Figure 1-28**.

1.9.4.2.2 Pit 16 and 17 Area LNAPL

LNAPL occurrence in Pits 16 and 17 in Building 7 was discussed previously in Section 1.7. Groundwater monitoring wells NY-MW-56 and NY-MW-57 were installed to the west and south of the pits (outside of Building 7) in order to characterize the extent of LNAPL (**Figure 1-17**). Inspection Pits 16 and 17 were isolated from the industrial waste sewer system in order to prevent the migration of LNAPL from the pits. Accumulated liquids including water and LNAPL are periodically removed from the pits and the pits are cleaned with a surfactant. Material removed during this process are disposed at a TSCA Facility.

Groundwater gauging is conducted in the area of Pits 16 and 17. The pits are monitored as routine inspections to identify when additional liquid removal and cleaning are required. LNAPL migration is limited to the Pits inside Building 7 and accumulation/recovery/cleaning related of this LNAPL will be addressed in coordination with Facility operations.

1.9.4.2.3 NY-MW-1 Area LNAPL

LNAPL was identified in NY-MW-1 with PCB concentrations greater than 500 mg/kg. The source of the LNAPL is reportedly related to Building 13. LNAPL thickness has ranged from not detected to 0.17 ft at NY-MW-1 during routine gauging. Additional monitoring wells NY-MW-25, NY-MW-40, and NY-MW-41 were installed to characterize the extent of LNAPL related to the NY-MW-1 area (**Figure 1-17**). No LNAPL was identified in NY-MW-25, NY-MW-40, or NY-MW-41 during any gauging event.

LNAPL in this area has been characterized and is localized. LNAPL is defined in a small area. Groundwater gauging is conducted in the NY-MW-1 area during routine events. LNAPL in NY-MW-1 is bailed during routine O&M events as practicable and disposed offsite at a TSCA facility.

1.9.4.2.4 Locomotive Yard LNAPL

During the Locomotive Track 1, 2, and 3 Improvement Project, LNAPL was identified in the excavation of Track 2. Groundwater monitoring wells NY-MW-51, NY-MW-52, NY-MW-53, NY-MW-54 and NY-MW-55 were subsequently installed in the Locomotive Yard to characterize the extent of LNAPL (**Figure 1-17**). Monitoring well NY-MW-8 is also located in the Locomotive yard. During routine gauging events, LNAPL was identified in NY-MW-8 on two occasions at thicknesses of 0.01 ft. and 0.02 ft. No LNAPL has been identified in monitoring wells NY-MW-51 through NY-MW-55 during any gauging events.

The migration pathway of LNAPL in this area is limited to storm water in the Locomotive Yard. Monitoring of stormwater conveyance is conducted in order to identify LNAPL infiltration in this area. Storm sewer cleaning and video inspection is conducted periodically, and maintenance is performed as needed to prevent the infiltration of LNAPL into the storm sewer system.

1.10 Contaminant Fate and Transport

In the Maintenance Facility, the primary potential contaminant migration processes are: 1) migration of PCBs adhered to Site soils through surface runoff, 2) cVOCs in groundwater, and 3) LNAPL. These processes are described herein.

<u>PCBs in Soil</u>

Constituent (primarily PCBs) transport at the Wilmington Maintenance Facility of most interest occurs through erosion of surface soil via stormwater. The migration of PCBs in Site soil via overland flow of stormwater is monitored as part of the PMP and NPDES programs. Erosion of surface soil is hindered by the presence of asphalt, concrete and other erosion controls including fabric and stone and stone berms. Erosion and sedimentation controls are targeted at locations where elevated concentrations of PCBs or sediment volumes are identified through the inlet protection pilot program and stormwater trackback investigations. Sediment migrating to the storm sewer system in the Outfall 002 drainage area discharges to the Shellpot Creek to the north of the Facility. The Outfall 002 discharge is monitored for PCBs and TCE during wet and dry weather as well as other constituents during wet weather discharge. The concentration of PCBs in surface water is used to calculate an estimated loading of PCBs to the Delaware River estuary and is reported annually in the PMP Annual Reports.

Constituents identified in surface and subsurface soil as part of this remedial investigation are included and considered in the HHRA summarized in Section 1.11.

In addition to surface soil migration via overland flow, groundwater transport of LNAPL and TCE in groundwater are a potential migration pathway at the Maintenance Facility (constituents identified in groundwater were summarized in Section 1.7).

<u>Groundwater</u>

<u>TCE in Groundwater</u>

TCE was identified in the vicinity of the Administration Building and Locomotive Shop. The area between the Administration Building and Locomotive Shop is underlain by fill material, silts and sand mixtures to a depth of 12 to 14 feet bgs. An approximately 10-foot thick gray silty clay was encountered at a depth of 12 to 14 feet bgs.

TCE and associated degradation products have been detected in soil and groundwater in the area between the Administration Building and Locomotive Shop. The source of TCE in this area appears to be related to the former TCE AST that was situated between the two buildings and the former degreaser pit which was located inside the Locomotive Shop (refer to **Figure 1-18**). Use of the AST and the degreaser pit was discontinued in the mid-1980's.

TCE has been reported in Administration Building basement dewatering sumps. Water is pumped from the building basement through a series of basement dewatering sumps, to a storm sewer along the west side of the building, ultimately discharging to Outfall 002. Historically, TCE has been detected at Outfall 002 during NPDES sampling. TCE monitoring is included in the NPDES permit during dry weather and stormwater flow. In order to minimize the contribution of TCE to the storm water system, basement sumps were connected to a GAC treatment system beginning on October 5, 2011.

The highest cVOC concentrations in groundwater were reported in the area between the Administration Building and Locomotive Shop (NY-MW-2) and inside the Locomotive Shop (NY-MW-31). In this area, the water table is encountered at a depth of approximately 3 to 5 feet bgs. Groundwater elevation maps indicate the overall direction of groundwater movement is to the east, from the Amtrak mainline tracks to the NED. This is consistent with the conceptual TCE groundwater isoconcentration maps provided in Section 1.7. NY-MW-4, located in the vicinity of NY-MW-2, is screened below the clay layer, reported only low VOC concentrations with recent GW results documenting no concentrations of VOCs. Comparison of the water level in NY-MW-2 and NY-MW-4 indicates an upward vertical head potential across the clay layer.

The concentration and composition of cVOCs in groundwater in the vicinity of the Administration Building appears to have been altered by natural fate and transport processes, including biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilization, transformation, or destruction. One such mechanism which is considered promising based upon pilot test data (as discussed in Section 3.5), is biologic degradation, specifically through reductive dehalogenation.

Biodegradation of organic constituents in groundwater may occur under both aerobic and anaerobic conditions. The biologic degradation of these compounds involves the oxidation of the hydrocarbon and the reduction by an election acceptor. A major metabolic pathway for the natural attenuation of chlorinated solvents is reductive dehalogenation. Reductive (anaerobic) dehalogenation is an anaerobic biological process whereby naturally occurring microorganisms degrade halogenated compounds like TCE and convert them into ethene, ethane, or carbon dioxide. Chlorinated VOC degradation is dependent on the presence of the appropriate microorganisms, nutrients, and energy sources. The biochemical transformation of chlorinated VOCs and energy is the result of enzymes produced by the microorganisms that act as catalysts for the degradation reactions. The overall constituent reduction mechanisms are greatly influenced by the interrelationship between several microorganisms and a series of chemical reactions that occur within the subsurface environment.

Through anaerobic dehalogenation, TCE may be transformed to dichloroethene (primarily cis-1,2-DCE and other DCE isomers), which in turn is transformed to vinyl chloride, before finally forming ethene or the end product of the reaction. Vinyl chloride can be de-halogenated by anaerobic and aerobic organisms; therefore, the vinyl chloride does not typically accumulate at a site unless weakly reducing conditions are prevailing. However, the accumulation of DCE isomers at a site is common and if the contamination is the result of reductive dehalogenation (rather than a DCE release), then the cis-1,2-DCE isomer is expected to be found in higher concentrations than the trans-1,2-DCE isomer and 1,1-DCE would be the least prevalent of the three isomers. When synthetic DCE is the source, then generally a 50/50 distribution of cis- and trans-1,2-DCE isomers would be observed.

Groundwater modeling was used to simulate fate and transport of dissolved chlorinated volatile organic carbon parameters including TCE and associated daughter products (cis-1,2-DCE and vinyl chloride). The selected groundwater flow model utilized for this study was BIOCHLOR version 2.2 which is based on the Domenico (1997) analytical flow model. The modeling was conducted based on baseline conditions prior to initiating the ERD Pilot Test Program. The model baseline conditions indicate that concentrations of cVOCs will not impact offsite surface water above DNREC-SIRS Screening Levels for Surface Water. This confirms field observations at Site monitoring wells down-gradient of the source area. A summary of the groundwater modeling for cVOCs is provided in Section 3.3.3.

The fate and transport of dissolved chlorinated VOCs is also affected by the Facility infrastructure. As has been mentioned, chlorinated VOCs have been detected in the basement sump water in the Administration Building. The operation of the basement dewatering sumps (which are generally located to the west of the former degreaser and TCE storage tank) likely has slowed the natural lateral migration of the chlorinated VOCs in groundwater to the east and may have drawn groundwater containing TCE towards the Administration building. In addition, backfill along the storm water sewer system piping may serve as preferential migration pathway. This is suggested by the elongation of the chlorinated VOC groundwater plume coincident with the east-west trending section of the Outfall 002 storm sewer system between Buildings 3, 16 and 17 to the south and Buildings 2, 4, 5, 14, 15, and 18 to the north. In addition, TCE has been detected in this section of the storm sewer during trackback investigations reported in the IDS Report suggesting groundwater infiltration into the storm sewer. Surface water monitoring is conducted via the NPDES Permit for the Facility.

Since chlorinated VOCs were detected in the Administration sump water, indoor air sampling has been conducted, and IRMs were implemented. Following implementation of the IRMs, no chlorinated VOC was detected in the first or second floor of the Administration Building (the occupied portions of the building). Indoor air sampling was also conducted in other buildings situated within 100 feet of the chlorinated VOC groundwater plume. No VOCs were detected in indoor air samples collected in those buildings. Indoor air sampling is conducted periodically to document conditions in the Administration Building.

LNAPL

As summarized in Section 1.7, LNAPL was identified at several locations across the Facility including the Locomotive Yard, Pit 16 and 17 area, NY-MW-1 area, and MH-14 area. LNAPL in these areas has been characterized laterally. The fate and transport of LNAPL in these areas is discussed below.

The Locomotive Yard LNAPL was identified in excavations related to the Track 1,2, and 3 Improvement Projects (discussed in Section 1.7). Monitoring wells NY-MW-51 through NY-MW-55 were installed in the Locomotive Yard to characterize the presence of LNAPL. Monitoring well NY-MW-8 was previously installed in this area. No measurable LNAPL was identified in NY-MW-51 through NY-MW-55 during any of the gauging events. Measurable LNAPL was identified in NY-MW-8 during two gauging events since 2012 up to 0.02 ft. of LNAPL.

Transport of LNAPL in the Locomotive Yard is primarily through infiltration to Maintenance Facility stormwater sewer and industrial waste sewer conveyance. The industrial waste sewer is routed through an onsite wastewater treatment system which includes oil separation. LNAPL retained from the industrial waste flow is disposed offsite. LNAPL infiltration into the stormwater system is monitored as part of the NPDES permit (DE0050962). Outfall 002 and Outfall 007 are monitored for Oil and Grease. Additionally, these outfalls are visually monitored monthly. Absorbent boom is placed at locations within the stormwater conveyance to address occurrences of LNAPL.

LNAPL identified in Pit 16 and 17 within Building 7 previously flowed to the industrial waste sewer and was treated by the onsite industrial waste system. These pits have been isolated from the industrial waste sewer conveyance. LNAPL that enters these pits is pumped out periodically and the pits are cleaned. Monitoring wells NY-MW-56 and NY-MW-57 were installed outside the building to the south and west. No LNAPL has been documented during routine gauging of these monitoring wells. The LNAPL in this area is considered immobile in relation to groundwater migration.

The NY-MW-1 area LNAPL was identified during groundwater gauging with thicknesses up to 0.17 ft. Monitoring wells NY-MW-40, NY-MW-41, and NY-MW-25 were installed in the vicinity of NY-MW-1; however, there was no LNAPL identified in any of these wells during routine gauging. Facility sewer systems are located hydraulically upgradient of NY-MW-1. NY-MW-25 is also located between NY-MW-1 and the Facility sewer systems. The LNAPL in this area is considered localized and immobile.

The MH-14 area LNAPL has been characterized laterally by monitoring wells and piezometers. As discussed in Section 1.7, a section of piping from MH-14 to the upgradient MH was replaced with a solid section of HDPE piping to prevent infiltration of LNAPL in the stormwater conveyance.

A LNAPL Conceptual Site Model was developed to address the mobility of LNAPL in this area and is summarized in Section 3.3.3. LNAPL distribution, mobility, and potential recoverability in this area was evaluated using site-specific data. Dissolved phase constituents were evaluated using groundwater analytical data collected at Site monitoring wells. Historical LNAPL thicknesses of wells near the edges of the estimated LNAPL body either do not exceed pore entry pressure of the surrounding porous medium or are delineated by locations with no observed LNAPL. Dissolved phase sampling results indicate that the LNAPL likely has low effective solubility for VOC and SVOC constituents. Additionally, the lack of an expanding groundwater plume further indicates that that the LNAPL is not migrating (i.e. is not mobile). Estimates of LNAPL transmissivity and recoverability indicate that the LNAPL at the Site is not practicably recoverable.

<u>Other Constituents in Groundwater</u>

PCBs, SVOCs and TAL-metals as well as chlorobenzene have been identified in groundwater at the Facility. Concentrations of these constituents were detected sporadically in monitoring wells. These constituents are likely identified in groundwater due to the entrainment of suspended solids during sample collection and not due to a release related to Facility operations. PCBs, SVOC and TAL-metals will be addressed through natural attenuation monitoring.

1.11 Summary of Human Health Risk Assessments and Wetland Assessments

Below is a summary of the human health and wetland assessments. These assessments were completed in accordance with the Revised RI/FFS Work Plan and Work Plan Addendum. Agency comments to Former Fueling Facility RSFFS, RSFFS Addendum and related Agency correspondence were also considered.

1.11.1 Human Health Risk Assessment Summary and Conclusions

The Human Health Risk Assessment (HHRA) summarized herein evaluates potential exposures to chemical constituents in soils at the Amtrak Maintenance Facility in Wilmington, DE. Additional information regarding the HHRA is presented in **Appendix 1-15** of this report. The Maintenance Facility (the Site) is a part of the Amtrak Wilmington Shops which have been the subject of ongoing environmental investigations. Stantec's work on behalf of Amtrak and American Premier Underwriters (APU) is being conducted under the Delaware Voluntary Cleanup Program (VCP) enacted under 7 Del. C. Chapter

91: Delaware Hazardous Substance Cleanup Act (HSCA). The Delaware Department of Natural Resources and Environmental Control (DNREC) is the lead regulatory agency. USEPA Region 3 (Region 3) has regulatory authority for TSCA and is involved because of the presence of PCBs.

The Amtrak Wilmington Shops play a critical role in passenger rail service on the Northeast Corridor. The Wilmington Shops are Amtrak's only facility for over-hauling electric locomotives. When the assets of the bankrupt Penn Central Railroad were transferred in 1976, the Federal Railroad Administration required Amtrak to execute a 999-year mortgage on all properties, including the Wilmington Shops. Amtrak will control the site into the future and has plans to continuously occupy the property for railroad operations. There are no uncertainties about how this property will be used in the future. Amtrak plans to record deed restrictions and environmental covenants as part of the Site remedy and include a Long-Term Stewardship Plan that is consistent with the selected remedy and future railyard operations.

The Maintenance Facility is located north of the Former Fueling Facility. The Maintenance Facility is bounded to the east by the former Conrail Edgemoor Yards (now owned and operated by Norfolk Southern), to the north by Shellpot Creek, and to the west by active mainline Amtrak track. As mentioned previously, for the purposes of this HHRA, the Maintenance Facility is considered the Amtrak property north of the area investigated during the Amtrak - Former Fueling Facility remedial investigation. The Maintenance Facility area of investigation encompasses approximately 52 acres; of which approximately 36 acres is paved or under building roof and 16 acres is unpaved.

The City of Wilmington, DE has zoned the land occupied by the Amtrak Wilmington Maintenance Shops for industrial use. The property will continue to be used for railroad operations into the foreseeable future. Other industrial properties surround the Site. Therefore, residential exposure scenarios are not appropriate. The site is an active facility with a guarded (24 hours a day) entrance gate, limiting unauthorized access. Therefore, trespasser scenarios are not appropriate. Potable water at the Site and in the vicinity of the Site is supplied by the City of Wilmington. Therefore, potable use of on-Site groundwater is not a complete pathway of exposure. Migration of vapors from cVOCs in groundwater to the indoor air of on-site buildings is being further mitigated through ongoing IRMs (refer to Section 1.8); therefore, inhalation of cVOCs in indoor air from groundwater is not a complete exposure pathway. As such, the potential for direct contact with COCs in soil was the only environmental medium with potentially complete pathways of exposure for human receptors at the Amtrak Wilmington Maintenance Facility evaluated in this HHRA.

Purpose of the HHRA

The purpose of this HHRA is to determine if Site-related chemical constituents in soil at the Maintenance Facility may pose unacceptable risks to people who use the Site now and in the future. The HHRA is an integral component of the overall risk assessment and risk management process for this Site. Consistent with DNREC (2017) and USEPA (2014a) guidance and policy, the findings of the HHRA are a component of the risk management discussion and selection of remedies for the Site presented in the RIFFS. The HHRA is one of many factors considered in the selection of remedies to protect public health and the environment; and demonstrates that the implementation of the preferred remedies (post-remediation scenario) is protective of human health.

Consistency with Applicable Regulations and Guidance

The HHRA is consistent with DNREC guidance for risk assessment (DNREC, 2017), the option for risk-based clean-up of large complex PCB contaminated Sites allowed by TSCA 761.61 (c), and USEPA OSWER guidance and policies. TSCA defaults to OSWER (Superfund) guidance for conducting risk assessments (USEPA, 2005a). Chemicals other than PCBs have been identified in soil at the Maintenance Facility and are subject to OSWER risk assessment guidance.

Approach to the HHRA

The HHRA was conducted assuming two different Site conditions: 1) an evaluation of potential exposures and risks under a theoretical and generic Baseline scenario to satisfy regulatory requirements; and 2) an evaluation of potential exposures and risks assuming the major risk-contributing contaminants of potential concern (COPCs) have been remediated to concentrations less than remediation goals, described as the Post-Remediation scenario.

The agencies have provided concurrence to utilize similar remedial goals as presented in the Addendum 2 – Revised Supplemental Focused Feasibility Study Report, Amtrak - Wilmington Former Fueling Facility (Stantec, October 2019). DNREC's July 11, 2019 e-mail correspondence to Stantec provided concurrence of utilizing these remedial goals for the Maintenance Facility.

The remedial goals established for the Former Fueling Facility and evaluated in this HHRA for the Maintenance Facility target soil treatment and removal to achieve an upper bound, cumulative cancer risk of less than 1E-04 and a non-cancer hazard index of less than 1.0 (by target organ system). As established for the Former Fueling Facility, the targeted soil removal of total PCBs >100 mg/kg and arsenic >300 mg/kg, and before any additional remedial action, will achieve a potential cancer risk within the EPA risk management range of 1E-04 to 1E-06. This is consistent with the National Contingency Plan (NCP) and *Role of the Baseline Risk Assessment in Superfund Remedy Selection* (OSWER Directive 9355.0-30, April 22, 1991). These risk and hazard estimates were prepared using EPA's default exposure assumptions for commercial properties, which are hypothetical and do not reflect the actual work practices or potential exposures of the Amtrak workers at the Site now, in the past or in the future. In addition to the targeted soil removal described above, a site-wide engineered cover would be placed across the 56-acre Site to significantly reduce the off-site migration of residual PCBs in surface soils and further limit the potential for direct contact exposure to the remaining soil by future site workers.

Although the soil excavation component of the Post-Remediation scenario targets soil removal to achieve an upper bound, cumulative cancer risk of less than 1E-04, the level of protection with the addition of engineered covers will be significantly more protective since all areas of soil will be covered, thus limiting or eliminating direct contact exposures. The proposed remediation (i.e., the combination of the targeted soil removal and subsequent engineered cover of the remaining soil) will result in a site-wide upper bound, cumulative cancer risk significantly less than DNREC's Voluntary Cleanup Program (VCP) target of 1E-05 (one in one hundred thousand) and a non-cancer hazard index of less than 1.0 for all constituents. This remedy will also include institutional and engineering controls to ensure the remedy is maintained into the future.

The variable values and algorithms used to estimate exposure and quantify cancer risk and non-cancer hazard for both the generic Baseline and Post-Remediation evaluations were the conservative default values embedded in the online Risk Assessment Information System (RAIS) Risk Calculator developed and maintained by the Oak Ridge National Laboratory (ORNL), which are much more likely to over-estimate rather than under-estimate risks (DNREC, 2017 and USEPA, 2014b).

Constituents of Potential Concern

Constituents of Potential Concern (COPCs) were identified for this HHRA via a two-step process. First, constituents detected in less than 5 percent of the samples were eliminated from further consideration in the HHRA per USEPA (1989) guidance. Secondly, the maximum detected concentrations of constituents detected in 5 percent or more of the samples were compared to the most recent (November 2019) DNREC HSCA Screening Levels. DNREC screening levels assume long-term residential exposure to chemicals in environmental media. DNREC does not publish screening levels for commercial/industrial land use. The DNREC HSCA screening levels are concentrations of chemicals in soil that are either a Background Threshold Value (BTV) for the State of Delaware or are consistent with the most current USEPA Regional Screening Levels (RSLs) based on a target cancer risk of 1E-06 or a target non-cancer hazard index of less than 0.1, whichever endpoint is more restrictive. Constituents detected in more than 5% of the samples and with maximum detected concentrations greater than their respective DNREC HSCA screening levels were identified as COPCs.

This two-step COPC screening process was applied to the two different data sets that were assessed in the Baseline and Post-Remediation HHRAs; surface soil (0 – 2 ft. depth interval) and total soil (0 – 10 ft. depth interval). The constituents identified as COPCs in surface soil and total soil, assuming Baseline conditions, are summarized below.

Constituents	COPC in Baseline Surface Soil	COPC in Baseline Total Soil
Antimony	X	X
Arsenic	X	X
Barium		X
Cadmium		X
Copper	X	X
Iron	X	X
Lead	X	X
Mercury	X	X
Nickel	X	X
Thallium	X	X
Trichloroethene	X	X
Acenaphthylene	X	X
Benzo(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Benzo(g,h,i)perylene	X	X
Benzo(k)fluoranthene	X	X
Carbazole	X	X
Chrysene	X	X
Dibenzo(a,h)anthracene	X	X
Dibenzofuran	X	X
1,4-Dichlorobenzene		X
Indeno(1,2,3-cd)pyrene	X	X
Aroclor-1248	X	X
Aroclor-1254	X	X
Aroclor-1260	X	X

Receptors

Two receptors (potentially exposed people) were evaluated for direct contact with soils at the Site; 1) Standard Outdoor Worker, and 2) generic Excavation Worker. Consistent with the ORNL on-line RAIS risk calculator, the generic Excavation Worker is assumed to have contact with soils while engaged in a 20-day project that is completed in one year. The Standard Outdoor Worker is a hypothetical receptor, that is the most highly potentially exposed receptor and is assumed to have daily contact with soils on-Site 225 days per year for 25 years (RAIS risk calculator default assumptions). It is important to note that no classification of Amtrak employee at the Wilmington Maintenance Facility has job duties requiring them to work out of doors more than 50% of the time on the Site.

The Agencies required the risk assessment for the Amtrak Former Fueling Facility to use hypothetical Standard Outdoor Worker exposure assumptions to evaluate the future potential risks to the workers at the Site. For this reason, this receptor was evaluated in this HHRA for the Amtrak Wilmington Maintenance Facility. The assumed potential exposures for this receptor are overly conservative for this Site, and do not represent the actual conditions that currently exist or will ever exist at the rail yard. Although Amtrak and APU fundamentally disagree with the Agency's position regarding the use of these unrealistic, potential exposure assumptions for the Site, the calculations are included as a hypothetical scenario to respond to the Agencies' previous comments. Current and anticipated rail yard receptors are significantly different (substantially less actual exposure) as compared to the hypothetical Standard Outdoor Worker.

Quantitative Estimates of Exposure and Risk

The algorithms and variable values used to quantify daily intake of COPCs in soil and estimate cancer risk and non-cancer hazard were consistent with DNREC (DNREC, 2017) and USEPA policy and guidance (USEPA, 1989; 2014b). DNREC guidance for risk assessment defaults to the ORNL RAIS online calculator to evaluate hypothetical receptors for COPCs. Default exposure factors for Standard Outdoor Workers and generic Excavation Workers embedded in the RAIS online calculator were used for all risk and hazard calculations for this HHRA for all substances except lead.

For lead, the USEPA Adult Lead Model (ALM) was used to evaluate potential exposures to inorganic lead from incidental ingestion of soil (USEPA, 2016b). The ALM estimates the 95th percentile blood lead concentration for the fetus of a pregnant woman from incidental ingestion of inorganic lead in soil. The ALM can also be used to calculate concentrations of lead in soil corresponding to site-specific receptor exposure duration and frequency.

The HHRA evaluated potential risks from direct contact with COPCs in upland soils at the Amtrak Wilmington Maintenance Facility. The HHRA evaluated potential exposures and receptors under generic Baseline assumptions of un-specified, (hypothetical) future industrial use of the Site in the absence of any modifications or mitigation of existing chemical contaminants. The HHRA also evaluated a Post-Remediation condition where it was assumed that concentrations of COPCs have been excavated or otherwise remediated by removal of soils with PCBs >100 mg/kg and Arsenic >300 mg/kg.

1.11.1.1 Results of the Baseline HHRA

The Baseline HHRA evaluated potential cancer risks and non-cancer hazards from direct contact with COPCs in soils under the hypothetical assumption that the Site could be developed for any type of commercial or industrial use in the future. These scenarios are not directly applicable to the Site since Amtrak controls the current use and will continue to control use of the Site, but they provide a conservative estimate of cancer risks and non-cancer hazards that can be used to make conservative risk management decisions. Amtrak plans to record deed restrictions and environmental covenants as part of the Site remedy. Amtrak has committed to long-term Site stewardship consistent with the selected remedy and future use for railroad operations. The Baseline HHRA assumes that no remediation or mitigation of soils has occurred, and environmental conditions remain as they are at the time this HHRA was prepared (2019).

Consistent with DNREC guidance (DNREC, 2017), two representative receptors were evaluated under the Baseline scenario: 1) Standard Outdoor Worker; and 2) generic Excavation Worker. As mentioned, the assumed potential exposures for these receptors are overly conservative for this Site in that they are not representative of the actual conditions that currently exist or will ever exist at the railyard.

Detailed results of the Baseline HHRA are presented in **Appendix 1-15**. The total cumulative cancer risks and non-cancer hazards for the Standard Outdoor Worker and the generic Excavation Worker are summarized below.

Estimated Baseline Cancer Risks and Non-Cancer Hazards

	Exposure Scenario	
	Standard Outdoor	**Excavation Worker**
Cancer Risk -	3.5E-05	3.1E-07
Non-Cancer Hazard		
Cardiovascular:	1.9E-02	3.8E-04
Dermal:	1.1E-01	1.5E-02
Developmental:	1.5E+00	9.6E-02
Hematological:	1.5E-02	5.3E-03
Hepatic:	NA	2.4E-06
Immune:	1.6E+00	1.1E-01
Neurological:	1.3E-02	1.0E-03
Ocular:	9.1E-02	1.5E-02
Renal:	NA	1.6E-03
Reproductive:	2.8E-03	3.9E-04
Other:	1.8E-02	5.4E-03

The Baseline HHRA identified arsenic, trichloroethene (TCE), and PCBs as the COPCs contributing the majority of the cancer risks, and TCE and Aroclor-1254 as the COPCs contributing the majority of the non-cancer hazards for the Standard Outdoor Worker. Baseline cancer risks were within the USEPA (1991a) risk management range of 1E-04 to 1E-06 for the Standard Outdoor Worker and generic Excavation Worker. Baseline non-cancer hazards were less than 1 for all target organ systems except developmental and immune system, which only slightly exceeded 1 for the conservative analysis associated with the Standard Outdoor Work receptor.

1.11.1.2 Results of the Adult Blood Lead Model

USEPA recommends using the Adult Blood Lead Model (ALM) to evaluate adult exposures to inorganic lead in soil at non-residential areas of Superfund and other hazardous waste sites (USEPA, 2001c; USEPA, 2002; USEPA, 2014c). The ALM estimates blood lead concentration in the fetus of a worker who develops a body burden of lead from non-residential exposure to inorganic lead in soil. The ALM assumes that the body burden of lead acquired by the mother reaches equilibrium and is available for transfer to the fetus for several years after the exposure ends.

For modelling blood lead levels in this HHRA, it was assumed that the Standard Outdoor Worker and the generic Excavation Worker were pregnant women. The frequencies of exposure (days/year) and soil ingestion rates were the same values used in the equations to calculate intake of COPCs for estimates of cancer risk and non-cancer hazard. The ALM was used to estimate the percent probability that the blood lead concentration of the fetus of an exposed worker would be greater than 5 micrograms of lead per deciliter of blood (µg/dL). The Centers for Disease Control (CDC 2019) statement on Childhood Lead Poisoning Prevention currently provides a Blood Lead Reference Value of 5 ug/dL based on the most recent data for children ages one to five years old in the U.S. population.

Results from the ALM are summarized below for the Standard Outdoor Worker and the generic Excavation Worker assuming Baseline conditions. The results presented below reflect the updated baseline maternal blood lead (PbB_0) and geometric standard deviation (GSDi) based on 2007-2012 National Health and Nutritional Examination Survey (NHANES) data per USEPA (2016b).

ALM Results for a Standard Outdoor Worker and a Generic Excavation Worker

Exposure Scenario	Mean Lead EPC (mg/kg)	Exposure Frequency (days/year)	PbB Adult Geometric Mean (µg/dL)	PbB Fetus 95th Percentile (µg/dL)	Probability Fetal PbB > 5 µg/dL
Outdoor Worker	87.4	225	1.2	2.7	0.4%
Excavation Worker	346.2	20	0.9	2.1	0.1%

The concentrations of inorganic lead in soil under Baseline conditions were predicted to result in 95th percentile blood lead concentrations less than 5.0 µg/dL (CDC Blood Level

Reference Value) in the fetus of a pregnant Standard Outdoor Worker and a pregnant Excavation Worker. As such, lead concentrations in soil under Baseline conditions would not be expected to contribute to fetal blood lead concentrations above the CDC Reference Value.

1.11.1.3 Results of the Post-Remediation HHRA

Although the soil excavation component of the post remediation evaluation targets soil removal to achieve an upper bound cumulative cancer risk less than 1E-04, the level of protection with the addition of engineered covers will be significantly more protective since all areas will be covered, resulting in a site-wide upper bound, cumulative cancer risk and non-cancer hazard significantly less than DNREC's regulatory (VCP) cleanup program cumulative target of 1E-05 and HI of less than 1.0 for all constituents.

The Standard Outdoor Worker and generic Excavation Worker evaluated in the Post-Remediation HHRA were the same receptors evaluated in the Baseline HHRA and are consistent with DNREC guidance (DNREC, 2017) which defaults to the RAIS on-line calculator.

The Post-Remediation HHRA evaluated potential cancer risks and non-cancer hazards from direct contact with COPCs in soils under the following assumptions:

- Soil locations reporting total PCB concentrations greater than 100 mg/kg will be excavated (consistent with the remedial goal for the Former Fueling Facility; refer to Section 2.3.1),

- TCE will be remediated through enhanced reductive dechlorination (ERD) in the ERD field-scale pilot test treatment area footprint (refer to Section 3.5); results for TCE in soil samples within the ERD treatment area were considered as under ongoing treatment and/or not available for exposure in the Post-Remediation HHRA (refer to ProUCL input table in **Appendix 1-15**). TCE in soils within the ERD treatment area will be addressed under the ERD program through project close-out (to be described in the LTS; refer to Section 6.0). Also, this area is under asphalt or concrete and the engineered cover will remain and be maintained in accordance with the LTS for the facility (further mitigating direct contact with soils), and

- Although a risk-driving constituent, arsenic was not reported above the target clean-up level of 300 mg/kg in any soil sample in the Maintenance Facility. Thus, no soil removal will be completed to address arsenic.

Similar to the Baseline condition, the Post-Remediation condition assumed the Site could be developed for any type of commercial or industrial use in the future. This scenario is not directly applicable to the Site since Amtrak controls the current use and will continue to control use of Site, but it provides a conservative estimate of cancer risks and non-cancer hazards that can be used to make conservative risk management decisions. Amtrak plans to record deed restrictions and environmental covenants as part of the Site remedy. As with the Baseline condition, under the Post-Remediation condition, two representative receptors were evaluated: 1) Standard Outdoor Worker; and 2) generic Excavation Worker.

Detailed results of the Post-Remediation HHRA estimated cancer risks and non-cancer hazards for the Standard Outdoor Worker and generic Excavation Worker exposure scenarios are presented in **Appendix 1-15**. The total cumulative cancer risks and non-cancer hazards for the Standard Outdoor Worker and the generic Excavation Worker assuming Post-Remediation conditions are summarized below.

Estimated Post-Remediation Cancer Risks and Non-Cancer Hazards

	Exposure Scenario	
	Standard Outdoor	**Excavation Worker**
Cancer Risk -	2.3E-05	3.7E-06
Non-Cancer Hazard		
Cardiovascular :	1.8E-02	2.2E-02
Dermal :	1.1E-01	3.7E-02
Developmental :	1.0E-01	1.2E-03
Hematological :	1.6E-02	1.8E-02
Hepatic :	NA	1.9E-05
Immune :	1.9E-01	1.7E-02
Neurological :	1.4E-02	7.6E-03
Ocular :	9.2E-02	1.5E-02
Renal :	NA	3.7E-03
Reproductive :	2.9E-03	4.0E-04
Other :	1.9E-02	1.9E-02

Estimated cumulative Post-Remediation cancer risks were less than the remedial target of 1E-04 for the Standard Outdoor Worker and the Excavation Worker, and non-cancer hazards were less than the target of 1.0 for the Standard Outdoor Worker and the Excavation Worker for all target organ systems from direct contact with COPCs in soils at the Site. Post-Remediation cancer risks were within the USEPA (1991a) risk management range of 1E-04 to 1E-06 for the Standard Outdoor Worker at the Site. As discussed in Section 3.0, the excavation of TCE-impacted sils in a portion of the ERD treatment area footprint is not practical due to Facility infrastructure; therefore, those soils will be addressed in-situ through the ERD program. Outdoor workers do not have direct contact with soil sin this area

Inorganic lead concentrations in surface soil assuming Post-Remediation conditions are less than lead concentrations in soil under Baseline conditions. Since the Baseline HHRA determined that lead concentrations in soil would not result in a blood lead concentration greater than the CDC Reference Value of 5 ug/dL in the fetus of a pregnant Standard Outdoor Worker, the concentrations of lead remaining in soil under Post-Remediation conditions also would not result in a fetal blood lead concentration greater than 5 ug/dL.

The generic Excavation Worker evaluated in the Post-Remediation HHRA is also a potentially relevant receptor for short-duration projects involving soil disturbance at the Site. The Post-Remediation HHRA assumed that no measures would be implemented to mitigate this receptor's contact with COPCs in soil; however, Amtrak has health and safety protocols for all work performed on its facilities to minimize environmental exposures at the Site. The estimated Post-Remediation cancer risk and non-cancer hazards for the Excavation Worker were less than the target levels of 1E-04 to 1E-06 and 1.0, respectively, from direct contact with COPCs in soils.

Inorganic lead concentrations in soil assuming Post-Remediation conditions are less than lead concentrations in soil under Baseline conditions. Since the Baseline HHRA determined that lead concentrations in soil would not result in a blood lead concentration greater than the CDC Reference Value of 5 ug/dL in the fetus of a pregnant Standard Outdoor Worker, the concentrations of lead remaining in soil under Post-Remediation conditions also would not result in a fetal blood lead concentration greater than 5 ug/dL.

1.11.1.4 HHRA Conclusions

1. Evaluation of cancer risk and non-cancer hazard for a hypothetical Standard Outdoor Worker satisfies the regulatory requirement to examine a conservative, generic Baseline scenario under the assumption that the property could be used for any type of commercial or industrial purpose in the absence of any remedial actions to address historical chemical contaminants in soils. However, this "Baseline" scenario is not representative of how the Site is used currently or how it will be used in the future and is more conservative than actual current or expected future site usage.

2. The Baseline HHRA identified arsenic, TCE, and PCBs as the major contributors to the estimated cancer risk and TCE and Aroclor 1254 as the major contributors to the estimated non-cancer hazards for the Standard Outdoor Worker.

3. Baseline cancer risks were within the USEPA risk management range of 1E-04 to 1E-06 for the Standard Outdoor Worker. Baseline Non-Cancer Hazards were less than 1 for all target organ systems for the Standard Outdoor Worker, except developmental and the immune system, which only slightly exceeded 1 in this conservative evaluation.

4. The Baseline HHRA estimated cancer risks and non-cancer hazards less than target levels of 1E-04 and 1.0, respectively, for a generic Excavation Worker. As such, COPC concentrations in soil are unlikely to pose adverse health effects in Excavation Workers.

5. The Baseline HHRA determined that concentrations of inorganic lead in soil under Baseline conditions were predicted to result in 95th percentile blood lead concentrations less than 5.0 µg/dL (CDC Blood Lead Reference Value) in the fetus of a pregnant Standard Outdoor Worker and a pregnant Excavation Worker. As such, lead concentrations in soil under Baseline conditions have been shown to be less than levels that could pose health hazards.

6. Excavation, construction, and other intrusive soil-disturbing activities at the Amtrak - Wilmington Maintenance Facility are subject to Amtrak's health and safety protocols.

7. The Post-Remediation HHRA estimated cancer risks were less than the target of 1E-04 for a Standard Outdoor Worker. The Post-Remediation HHRA estimated non-cancer hazards to be less than the target of 1.0 for a Standard Outdoor Worker.

8. The Post-Remediation HHRA identified arsenic and PCBs as the major contributors to the estimated cancer risk and TCE and Aroclor 1254 as the major contributors to the estimated non-cancer hazards for the Standard Outdoor Worker.

9. The Post-Remediation HHRA estimated cancer risks and non-cancer hazards less than target levels of 1E-04 and 1.0, respectively, for a generic Excavation Worker. As such, COPC concentrations in soil are unlikely to pose adverse health effects in Excavation Workers assuming Post-Remediation conditions.

1.11.2 Wetlands Evaluation of the Amtrak Wilmington Maintenance Facility

This evaluation presents the results of a wetland delineation conducted at the Amtrak Wilmington Maintenance Facility in Wilmington, New Castle, Delaware. The delineation was conducted on August 27 and 28, and October 24, 2018.

This wetland evaluation summary has been prepared to satisfy the requirements U.S. Army Corp of Engineers (USACE) under Section 404 of the Clean Water Act and the requirements of the Delaware Department of Natural Resources and Environmental Control (DNREC).

Wetlands were identified per the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory1987) and the applicable *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Version 2.0* (USACE 2010). Per these references, the definition of wetlands is:

Wetlands are those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

This definition addresses three characteristics of wetlands: (i) hydrophytic vegetation, (ii) hydric soils, and (iii) wetland hydrology.

The objectives of the wetland evaluation were to verify online resources which depict natural resources that may occur on-site and determine current wetland boundary lines within the study area.

1.11.2.1 Wetlands Evaluation Methodology

The site review for wetlands and the delineation of wetlands was conducted in general accordance with the USACE 1987 Wetland Manual (Environmental Laboratory, 1987) and Atlantic and Gulf Coastal Plain Regional Supplement (USACE, 2010), herein referred to as the *Supplement*. The means and methods used to delineate the wetland areas are described in the following subsections.

Off-site identification of wetlands included a desktop review of the jurisdictional status of the parcel using topographic maps, aerial photography, U.S. Fish & Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping, the Natural Resource Conservation Service (NRCS) Web Soil Survey and Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map. These maps and aerial imagery were also used to pre-screen the area for types of vegetation cover and surface water features. A copy of the generated USFWS NWI Map is provided as **Appendix 1-16, Figure 2**, a copy of the NRCS Web Soil Map is provided as **Appendix 1-16, Figure 3**, and a FEMA Flood Insurance Rate Map as **Appendix 1-16, Figure 4**.

Stantec performed a field evaluation of the study area on August 27, 2018 and October 24, 2018. The wetlands were identified using three on-site identification methodologies; vegetative, hydrologic and soil features. The wetland delineation was conducted in accordance with the multi-parameter approach outlined in the USACE Wetland Delineation Manual (Y-87-1) and the *Supplement*. As stated above, federal wetland definition for an area to be classified as a wetland under the USACE definition, an area must meet three criteria: the dominance in hydrophytic vegetation, the presence of hydric soils, and evidence of wetland hydrology. Locations within the study area that exhibited all three criteria were delineated as wetlands.

Flagging was placed at the wetland boundary line and data points surveyed at each wetland location. All flags were surveyed using a Trimble GeoXH handheld GPS to collect sub-foot accuracy.

A walk-over reconnaissance of the site was conducted, and a vegetation inventory was compiled. The vegetation is identified and evaluated for potential wetland vegetation indicators specific to the *Supplement* as defined by the USACE. Scientific names and wetland indicator statuses for the vegetation identified conform to those listed in the National Wetland Plant List (NWPL): 2016 Update of Wetland Ratings.

Wetland indicator status ratings and their rating categories, as described in the National List of Plant Species that Occur in Wetlands (Reed 1988).

- Obligate Wetland (OBL) - Almost always occur in wetlands.
- Facultative Wetland (FACW) - Usually occur in wetlands but may occur in non-wetlands.
- Facultative (FAC) - Occur in wetlands or non-wetlands.
- Facultative Upland (FACU) - Usually occur in non-wetlands but may occur in wetlands.
- Obligate Upland (UPL) - Almost never occur in wetlands.

In addition, unofficial statuses that were deemed applicable to this delineation include the following.

- Not Listed (NL) – This was applied to vascular plants that are not listed as hydrophytes in any region, and therefore are not included on the NWPL. These species are entered as UPL plants on wetland determination data forms.
- Not Applicable (NA) – This was applied to plants that were not identified to species level, as well as to those species that are non-vascular or parasitic and by definition are not included on the NWPL.

Hydrophytic (wetland) vegetation communities were determined to be present when: 1) all of the dominant species were FACW and/or OBL (Rapid Test for Hydrophytic Vegetation); 2) greater than 50 percent of the dominant species' indicator statuses were FAC, FACW, or OBL (Dominance Test); and/or 3) when the calculated prevalence indices were equal to or less than 3.0.

The presence, potential presence, or absence of wetland hydrology was determined in accordance with the indicators presented in the USACE supplement (USACE, 2012). The hydrology evaluation for wetlands was conducted by visual clues of primary and secondary wetland hydrological indicators including inundation, soil saturation, surface water, oxidized rhizospheres, drift lines, drainage patterns, and moss trim lines on trees among other indicators listed in ACOE methodology. Depth to soil saturation, inundation, and surface water, if present, were measured within the top 12 inches of soil.

The presence, potential presence, or absence of wetland hydrology was determined in accordance with the indicators presented in the Corps *Supplement*. These indicators are categorized into 17 primary and 11 secondary indicators within the four groups outlined on the data sheets.

For the soil parameter, soils were visually examined to determine the presence or absence of hydric soil features in the top 6 to 24 inches of soil. The soil samples were collected from the surface by using a hand auger. The depth of the samples was sufficient to determine changes in upper horizons and to observe field indicators of nonhydric/hydric soils. Features such as colors indicating reducing conditions, and the presence or absence of redoximorphic features were utilized in making the determination of whether a soil was considered hydric. Munsell® Soil Color Charts were used to assign standard notations to the samples. Hydric soils are present when the soil matrix has a chroma of 1 or a chroma of 2 with redoximorphic features such as redoximorphic concentrations or mottles. Chroma colors are derived from the Munsell color charts.

In addition to the soil samples, the NRCS Web Soil Survey website was used to obtain a custom soil map for the study area. This soil map is provided as **Appendix 1-16, Figure 3**.

Hydric soils indicators established in the *Manual*, *Supplement*, and *Field Indicators of Hydric Soils in the United States, Version 7.0* (USDA-NRCS, 2010) were used to determine the presence of characteristic soil morphologies resulting from prolonged saturation and/or inundation.

1.11.2.2 Wetlands Evaluation Results

The study area is located in the Wilmington North USGS quadrangle map (**Appendix 1-16, Figure 1** - USGS Site Location Map). This illustrates the study area northeast of the Delaware River. Water within the study area flows either north into Shellpot Creek then into the Delaware River, or south into Brandywine Creek then into the Christina River. The elevation of the Amtrak Wilmington Maintenance Yard is between 10 to 20 feet above mean sea level (msl).

National Wetlands Inventory Maps (NWI) identified wetland habitats and vegetation communities within the study area (**Appendix 1-16, Figure 2** – NWI Map). Habitats and communities identified by NWI correspond to the classification developed by Cowardin et al. (1979). According to the NWI database, several wetlands were identified in the study area and including; four wetlands classified as palustrine emergent wetlands, and three areas as palustrine scrub/shrub or palustrine forested. Surface water within the study area was also illustrated within NWI database.

Based on USDA NRCS soil maps, there is one soil mapping unit within the study area (**Appendix 1-16, Figure 3** – NRCS Soils Map), namely: Udorthents, wet substratum (UwA). According to United States Department of Agriculture (USDA)'s New Castle County Delaware list of Hydric Soils, there are no hydric soils within the study area, though the listed soil is in the hydrologic soil grouping "C". Group C soils have a slow infiltration rate when thoroughly wet. Soils in this grouping consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

The majority of the study area is within a Federal Emergency Management Agency (FEMA) designated 100-Year Flood Hazard Area (**Appendix 1-16, Figure 4** – FEMA 100-Year Flood Map).

the wetlands identified are classified within the Palustrine System, which includes all non-tidal wetlands dominated by trees, shrubs, emergent vascular plants, emergent mosses or lichens, and tidal wetlands where the salinity is below 0.5%. The study area wetlands include the following types and combinations of palustrine wetlands.

Palustrine Emergent Persistent (PEM1) – These are wetlands dominated by herbaceous species that normally remain standing at least until the beginning of the next growing season.
Palustrine Scrub/Shrub (PSS) – These wetlands are characterized by woody vegetation that is less than six meters tall. In the study area, scrub/shrub wetlands are dominated by broad-leaved deciduous shrubs and saplings (PSS1).

Palustrine Forested (PFO) – These wetlands are characterized by woody vegetation that is six meters tall or taller. In the study area, forested wetlands are dominated by broad-leaved deciduous trees (PFO1).

Most of the wetlands observed were PEM wetlands with areas of PSS. The typical herbaceous wetland vegetation was comprised of dense stands of common reed. Other herbaceous vegetation was observed but was not dominant and is listed on the data sheets and on the observed vegetation list located in **Appendix 1-16**. In general, the wetland fringe vegetation consisted of dense growth of shrub honey suckle, shrub poison ivy and blackberry brambles.

Vegetation within the upland community was dominated by dense stand of honeysuckle shrubs with limited accessibility. Other woody plant species included box elder, tree of heaven, honey locust, winged sumac, red cedar, crabapple, multiflora rose, and poison ivy. Herbaceous upland vegetation consisted of snakeroot, goldenrod, ragweed, mugwort, and common mullein. The upland community is characterized in the data sheets and listed vegetation in **Appendix 1-16**.

The site is within the Brandywine portion of the Delaware River basin. Local drainage is to three drainage ditches, identified as Eastern Drainage Ditch, Western Drainage Ditch and Northeast Drainage Ditch.

The study area's wetland hydrology is predominantly from precipitation, overland drainage and from high water/flooding of the ditches.

The wetlands are directly connected to the ditches and receive waters during high flow events. Primary indicators of wetland hydrology present included surface water, saturation, and high-water table. Secondary indicators of wetland hydrology that were present included drainage patterns, geomorphic position, microtopographic relief and FAC neutral test.

Soils with low chromas were encountered in the wetlands. The wetland soils were mucky organic to black (typically 10YR 2/1) organic sandy silt.

The upland habitat community within the study area consisted of compacted fill material with varying amounts of miscellaneous debris. Upland soils were generally yellowish brown (10YR 5/3 to 10YR 5/4) gravelly sand to silt.

1.11.2.3 Wetlands Evaluation Summary

During the field investigation completed in August and October 2018, two wetlands of approximately a combined 0.14 acres (6,098 square feet) were identified within the study area. Wetlands (Wetland NY-A and NY-B) were identified in the Maintenance Facility portion of the property.

The wetlands were characterized as palustrine emergent (PEM). Wetland and upland habitat communities observed within the Amtrak Maintenance Facility were dominated by invasive plant species and contained compacted fill material. Brief summaries of each delineated resource are included below. Wetland delineation survey, additional details and photographs are in **Appendix 1-16**.

Identifier	Acres	NWI Classification	Comments
NY-A	0.10	PEM	Wetland NY-A is located north of Outfall 002 and drains to the Shellpot Creek. Vegetation is heavily dominated by common reed which are within the boundaries of the Outfall 002 Drainage Ditch. Soils were not evaluated at this wetland.
NY-B	0.04	PEM	Wetland NY-B is associated with the Shellpot Creek in the northern portion of the Project Area. The hydrology is connected to high levels of ground water and surface water overflow from the Shellpot Creek

2.0 REMEDIAL ACTION OBJECTIVES

Provided below is discussion of the remedial action objectives, applicable or relevant and appropriate requirements (ARARs), risk-based remedial goals, and discussion of impacted media. The remedial action objectives, ARARs, and risk-based remedial goals are consistent with those described in the June 2017 Revised Supplemental Focused Feasibility Study Report (RSFFS) for the Former Fueling Facility (DE-0266), the September 2018 Addendum to the RSFFS (RSFFS Addendum 1) and the October 2019 Second Addendum to the RSFFS (RSFFS Addendum 2). DNREC's July 11, 2019 e-mail to Stantec confirmed that it is acceptable to apply the remedial goals for the Former Fueling Facility (DE-0266) to the Maintenance Facility (DE-0170). This discussion of remedial action objectives and remedial goals pertains to soil, sediments and LNAPL/groundwater in the Outfall 002 drainage area and in the Outfall 007 drainage (soil and sediments in the Outfall 007 drainage area were addressed in the recommended remedy for the Former Fueling Facility as described in the RSFFS).

2.1 Remedial Action Objectives

Remedial action objectives are the medium- or operable unit-specific goals of the remediation activities. The goals are crafted to achieve the ultimate desired result of remediation—the protection of human health and the environment. To achieve this end, the remedial action objectives are framed in the context of the contaminant of concern, the current and anticipated exposure routes and receptors, and the contaminant levels that would be appropriate for end conditions at the Site. Remedial action objectives should specify both contaminant levels and exposure routes, because preventing the exposure to a contaminant is as effective as removal of the contaminant. Environmental protectiveness often aims to restore impacted resources, and thus the environmental objectives must also include both the medium of interest and the desired or required post-remediation contaminant levels. The remedial action objectives, initially based in readily accessible reference doses and standards, should ultimately reflect the results of site-specific risk assessments and exposure evaluations.

Quantitative and qualitative remedial action objectives have been developed for upland soils, sediments, and LNAPL/groundwater. These objectives consider TMDLs and Waste Load Allocations set by the DRBC in 2005 in Resolution No. 2005-9 to amend the *Water Quality Regulations* and *Comprehensive Plans*. The DRBC, in conjunction with the USEPA, addressed elevated PCB levels in the Delaware estuary, setting PCB TMDLs for upstream zones on the Delaware River. The amendments also required PMPs for PCB loading from Sites within those zones (Zones 2-6). Amtrak currently has an active NPDES permit which identifies stormwater outfalls at the Facility.

2.1.1 Soil Remedial Action Objectives

Remediation to cumulative cancer risk within EPA's risk management range of 1E-04 to 1E-06 and to a non-cancer hazard index of less than 1.0 is consistent with the National Contingency Plan (NCP) and *Role of the Baseline Risk Assessment in Superfund Remedy Selection* (OSWER Directive 9355.0-30, April 22, 1991). These risk and hazard estimates were prepared using EPA's default exposure assumptions for commercial properties, which are very conservative and do not reflect the actual work practices or potential exposures of the Amtrak workers at the Site. Consistent with the Former Fueling Facility, soil removal areas are defined as tPCBs > 100 mg/kg and arsenic > 300 mg/kg (arsenic was identified as a constituent of interest in the Former Fueling Facility but was not identified at concentrations > 300 mg/kg in the Maintenance Facility). Additional remedial action objectives include:

- Pathway elimination of direct contact of surface water with Site PCB soils,
- Comply with HSCA, TSCA, and other ARARs,
- Minimize the migration of PCBs in surface soils to the drainage ditches, which is consistent with the PMP for the site,
- Control soil erosion to minimize the migration of PCBs to site sediments, minimizing the future recontamination of sediments and aiding in the realization of the sediment remedial action objectives, and
- Protect human health by removal of site soils to a cumulative cancer risk of 1E-04 and to a non-cancer hazard index of less than 1.0 by target organ/system and further mitigating potential exposure to Site soils through installation of caps and engineered covers.

2.1.2 Sediment Remedial Action Objectives

The following remedial action objectives for sediments at the Maintenance Facility are consistent with the RSFFS (for the Former Fueling Facility):

- Pathway elimination of direct contact of surface water with site PCB impacted sediments,
- Comply with HSCA, TSCA, and other ARARs,
- Reduce the exposure of ecological receptors to site sediments, minimizing the pathway for potential migration of PCBs in sediments, and

- Reduce the PCB loading from the Site which is consistent with the PMP for the Site.

2.1.3 LNAPL/Groundwater Remedial Action Objectives

Remedial action objectives for LNAPL/groundwater in the Maintenance Facility are consistent with the RSFFS (for the Former Fueling Facility) as described as follows:

- Comply with HSCA, TSCA, and other ARARs,

- Reduce the quantity and mobility of LNAPL in the subsurface to prevent LNAPL (and PCBs in the LNAPL) from impacting site surface water and sediments, and

- In the May 17, 2015 Agency letter pertaining to the Former Fueling Facility (DE-0266), DNREC and EPA accepted the concept of removal of the LNAPL to the extent practical and monitored natural attenuation (MNA) of the dissolved petroleum compounds. As stated in the letter, Agency approval will require: 1) natural attenuation modeling to demonstrate that dissolved contaminants will degrade to an acceptable industrial level in a reasonable timeframe (approximately 20 years or less) and 2) vapor barriers will be a necessary component of any new construction.

Risk to human health through groundwater pathway has been addressed through the implementation of IRMs to address potential vapor migration into occupied buildings [primarily associated with chlorinated volatile organic compound (cVOC) occurrence in groundwater], natural biodegradability of the constituents of fuel oil, and because the groundwater is not used as a source for potable water supply. As will be further described in Section 3.0, the enhanced reductive dechlorination (ERD) pilot test activities have significantly reduced dissolved cVOC concentrations in groundwater. The Site is also within the City of Wilmington Groundwater Management Zone.

In accordance with the NPDES permit for the Site, surface water quality will continue to be monitored at Outfall 002 and Outfall 007. Outfalls 002 and 007 receive groundwater from the Maintenance Facility through groundwater infiltration to the storm sewer system in some areas. Outfall 002 drains to Shellpot Creek while Outfall 007 drains to the Eastern Drainage Ditch. The NPDES permit provides the framework for water quality sampling procedures to continue monitoring surface water leaving the Site. Because the indoor air IRMs are being maintained and the groundwater beneath the Maintenance Facility discharges to drainage features, the Eastern Drainage Ditch, the Shellpot Creek and NED are the primary exposure receptors considered.

2.2 *Applicable or Relevant and Appropriate Requirements*

Section 121 of CERCLA, part of the Superfund Amendments and Reauthorization Act (SARA), federal environmental regulations that are applicable or relevant and appropriate to the on-site remediation of hazardous material must be determined in order to properly develop remedial action objectives and screen remedial alternatives. Local and state regulations must also be taken into consideration in the case of a more stringent or additional regulation than what is federally required. The Delaware Hazardous Substances Cleanup Act (HSCA) gives DNREC the authority to remediate the Site. The HSCA Voluntary Cleanup Program allows potentially responsible parties (PRPs) to choose to move forward with remediation under HSCA. Applicable or relevant and appropriate requirements (ARARs) will govern the implementation and operation of the selected remedial alternative. The selected remedial alternative must comply with all ARARs or have just cause for a waiver of a particular ARAR, as required by Section 121(d) of CERCLA.

Applicable requirements are those that address a specific hazardous material or certain situation at a Superfund Site. Relevant and appropriate requirements pertain to situations similar enough in nature to those encountered at the Site that they should be included. Furthermore, certain criteria and guidelines that may not be legally enforceable at the Site but may be helpful in ultimately selecting a remedial alternative, are included in this section as items "to be considered" (TBC).

ARARs can be classified into three categories: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are numerical values based on risk or health hazards that help set cleanup levels at Superfund Sites. These include maximum contaminant levels (MCLs) and Water Quality Criteria (WQC). Location-specific ARARs are those that set restrictions on the concentrations of hazardous materials that can be present in an environmentally sensitive area such as a floodplain or wetland. They also impose restrictions on the types of activities that can be performed in these environmentally sensitive areas. Action-specific ARARs are limitations to the actions or conditions that can be taken with respect to certain hazardous substances. These are technology- and activity-based requirements that include many RCRA and Clean Water Act (CWA) regulations.

For the sake of the clarity of this report, the ARARs will be organized into local, state, and federal regulations, followed by TBCs.

2.2.1 Local

Groundwater Management Zone

A Groundwater Management Zone (GMZ) is a delineated land area adjacent to and including a contaminated Site where DNREC has determined that new drinking water wells must be restricted in order to protect public health and safety (DNREC-SIRS website). An excerpt from the "Memorandum of Agreement between the Division of Water and Division of Waste and Hazardous Substances," this state regulation (DE Code Title 7, Chapter 79, Subchapter II) is manifested at the local level in that the entire City of Wilmington, DE, falls within a GMZ. The location of the Amtrak Site within the GMZ dictates that future development on the remediated Site may not include the drilling of new drinking water wells.

Floodplains

The City of Wilmington, DE, is located in the County of New Castle, which has its own regulations regarding floodplains. The Amtrak Site is located in a flood fringe, as delineated by Federal Emergency Management Agency (FEMA) floodplain maps (Zone AE). The New Castle County Code of Ordinances, Chapter 40, sets restrictions on building and filling in the floodplain and flood fringe. Any land disturbance activity must be shown not to "increase the water surface elevation of the one hundred (100) year flood plain at any point in the community," and not to reduce the area of the floodplain on the parcel "by more than ten (10) percent in conjunction with channel improvements, flood storage, and detention which would have the effect of reduction of the floodplain elevation" (40.10.314 B-D). Construction activities in the floodplain must also follow requirements for erosion control. Any activities expected to produce significant change to the on-site floodplain must file for a floodplain permit application, which must include a detailed hydrologic and hydraulic study (40.10.313 A).

2.2.2 State

Uniform Environmental Covenants Act

In accordance with the Uniform Environmental Covenants Act (Delaware Code Title 7, Chapter 79, Subchapter II), (UECA) any environmental covenant associated with remediation activities must be made known to future developers of the remediated land. "The owner…shall provide a copy of a signed environmental covenant as required by the Department to…all persons holding a recorded interest in the real property; all persons in possession of the real property subject to the environmental covenant" (7912(a)(2-3)). The Department maintains a registry of all covenants, which are filed similarly to deeds and have the same formalities as deeds.

Storm water Regulations

Delaware has state regulations for the control of point and nonpoint pollution to its waterways, with its own permitting and monitoring requirements that include compliance with NPDES standards (DNREC Regulations Governing the Control or Water Pollution, Section 6). Storm water quality issues are also addressed by the Delaware Sediment and Storm Water Regulations, which dictate requirements for sediment and storm water management programs. Pertinent regulations focus on the quantity and quality of storm water runoff; in terms of quantity, the post-development peak runoff rates for the 2-, 10- and 100-year (3.2", 4.8". and 8.0", respectively) storm frequency events must be less than or equal to the pre-development peak runoff rates. The quantity control measures must be complied with unless a waiver is obtained, on a case-by-case basis (Delaware Code Title 7, 5101.10.3.4). Quality controls must be designed in keeping with the 2" NRCS Type II rainfall event (to a 1" runoff max). Criteria for quality control must be met unless a waiver is obtained, on a case-by-case basis (5101.10.3.5).

Wetlands

As wetlands have been observed on the Amtrak site, Delaware's Wetlands Regulations (Delaware Code Title 7, 7502) will apply. Part 12 details standards for permits required at certain Sites. The permit system is in place to evaluate the environmental effect of a proposed activity on a wetland and prevent any undue harm to the habitat and aesthetics of the wetland.

Hazardous Substances Cleanup Act

HSCA gives DNREC the authority to ensure cleanup of facilities with "release or imminent threat of release" of hazardous substances, which allows the state to clean up sites that are not being remediated by the federal Superfund program and voluntarily take control of on-site remediation activities. For Sites where HSCA is governing the cleanup efforts, a certification of the remedy must be obtained after remediation activities have been completed at the Site (Delaware Code Title 7, Chapter 91).

Subaqueous Lands

Subaqueous lands are lands submerged beneath waterways. For tidal waters, Delaware Code Title 7, Chapter 72, defines this as any land below the mean low tide line; for non-tidal waters, this is defined as any land below the ordinary high-water mark. Private owners of subaqueous lands are required by the Delaware Code to get a permit to undertake activities on or near the subaqueous lands that may contribute pollution to public waters. A permit or letter of approval must also be obtained in order to fill in or work in the subaqueous land.

2.2.3 *Federal*

Clean Water Act

The CWA, supplemented in large part by Delaware's Regulations Governing the Control of Water Pollution, establishes requirements for actions that affect surface water, including limitations for the concentration of contaminants of concern. Further CWA regulations are supported by Delaware's Wetlands Regulations (Title 7, 7502), in which specifications are set forth regarding the disturbance of wetlands. As wetlands have been established on the Amtrak Site, any disturbance of the wetlands requires a permit and possible resultant restoration or mitigation pursuant to regulations such as 40 CFR 230 and 33 CFR 323. 33 CFR 332 establishes the practice of compensatory mitigation in cases of wetland disturbance. Compensatory mitigation is "restoration, establishment, enhancement, and/or…preservation of aquatic resources." Delaware's Water Pollution Control Regulations (Part II (5.10)(a)(7)(C)(i)) allow the purchase of mitigation bank credits to substitute for direct compensatory mitigation practices.

The CWA also establishes the need for a NPDES Permit for remedial construction activities that impact storm water quality and that generate water requiring treatment before discharge to surface waters. The NPDES Permit sets forth sediment and erosion control measures and sampling needs for the Site in order to conform to certain water quality standards. The Amtrak Site currently has an active NPDES Permit which identifies six storm water outfalls.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) allows the USEPA to track, enforce testing on, develop regulations for the use of, and ban or limit the production and/or import of chemicals produced and/or imported into the United States. Furthermore, it allows the USEPA to regulate chemicals that threaten the health of humans and/or the environment. TSCA 40 CFR 761.61 sets forth regulations for PCB remediation waste and describes two different approaches to proceeding with remediation of PCBs; the self-implementing approach described in 40 CFR 761.61(a) and the risk-based approach as allowed by 40 CFR 761.61(c). As described in 40 CFR 761.61(a), EPA states "EPA designed the self-implementing procedure for a general, moderately-sized site where there should be low residual environmental impact from remedial activities. The procedure may be less practical for larger or environmentally diverse sites. For these other sites, the self-implementing procedure still applies, but an EPA Regional Administrator may authorize more practical procedures through paragraph (c) of this section." The Site is clearly not a "general moderately sized site where there should be low residual environmental impact from the remedial activities", thus the requirements of 761.61(a) are not applicable. Since the Site is "larger" and "environmentally diverse", it is appropriate to evaluate "more practical procedures" under 40 CFR 761.61(c). It is noted that a Risk Based approach to the remediation of the PCB waste at the Site would be consistent with the Risk Based approach to remediation conducted at DNREC HSCA Sites for all other substances of environmental concern other than PCBs.

Jurisdictional Determination

Waters on-site may be assessed to determine if they constitute "waters of the United States" under Federal regulation 33 CFR 328. If the waters are determined to be US waters, the United States Army Corps of Engineers (USACE) has jurisdiction over them, and any remediation activities having to do with the waterway, or its associated wetland will be under the authority of the USACE.

2.2.4 To Be Considered

Polychlorinated Biphenyl (PCB) Site Revitalization Guidance

The USEPA issued the PCB Site Revitalization Guidance under TSCA in November 2005; this document will be used as a reference for the Amtrak Site in development and implementation of remedial alternatives.

Vapor Intrusion

LNAPL and groundwater potentially poses risk for future building developments on-site. The USEPA's Office of Solid Waste and Emergency Response (OSWER) issued guidance documents to evaluate the potential for vapor intrusion from groundwater and soils that may pose significant airborne risks to human health at cleanup Sites. These documents provide a basis for evaluating and preventing the potential creation of indoor air exposure pathways to volatile organic compounds dissolved in groundwater as well as volatized LNAPL hydrocarbons. Delaware HSCA also addresses vapor intrusion as an exposure pathway, and it details conditions under which a vapor intrusion investigation would have to be carried out. If the results of a risk assessment show the need to take action, remediation installations, such as vapor barriers, must first be approved by the state prior to on-site implementation. As described in Section 1.8, IRMs have been implemented and maintained and site reconnaissance has been performed (in accordance with DNREC's March 2007 Vapor Intrusion Policy) to verify that currently LNAPL and groundwater do not pose a risk to indoor air.

Dust and Odor Issues

According to the DNREC Site Investigation and Remediation Section (SIRS, formerly SIRB), dust issues encountered on-site should be addressed in the site Health and Safety Plan (HASP). Odor and inhalation issues, as detailed in HSCA guidance documents, are typically classified and addressed by the ceiling values for organics in soil. Odor issues related to LNAPL should also be addressed in the HASP.

Endangered Species Act

The Endangered Species Act of 1973 aims to conserve the ecosystems that sustain populations of threatened and endangered species of plants and animals. Under the Act, governed by the US Fish and Wildlife Service, states are to establish conservation efforts to protect the land inhabited by threatened and endangered species. Should threatened and/or endangered species be found in the wetlands on the Amtrak Site, the wetland habitat must be restored or reestablished once remediation activities have been completed.

2.3 Determination of Remediation Goals and Description of Contaminated Media

The following is a description of the risk-based remediation goals for soil, sediment and LNAPL/groundwater. Also included is description of the media volumes considered for remediation.

2.3.1 Preliminary Risk-Based Remediation Goals

As described previously 40 CFR 761 provides two primary options for remediation of waste at PCB contaminated sites: 1) Self-implementing on-site cleanup and disposal of PCB Remediation Waste [40 CFR 761.61(a)] and 2) Risk-based Disposal Approval [40 CFR 761.61 (c)]. TSCA risk-based [40 CFR 761.61 (c)] remedial goals are medium-specific goals developed to protect human health and the environment as previously discussed, the approach described by 40 CFR 761.61(c) is most applicable to the situation at this Site.

The risk-based approach is most appropriate for the Amtrak Wilmington Maintenance Facility given the site complexity. This is consistent with the development of the soil remedial goals for the Former Fueling Facility (DE-0266), as applied to the Maintenance Facility.

The Upland Soil remedial goal targets soil removal to achieve an upper bound, cumulative Cancer Risk of less than 1E-04 and a hazard index of less than 1.0 (by target organ system) for the standard outdoor worker after targeted soil removal and before any additional remedial action. Remediation to cumulative cancer risk within the EPA's risk management range of 1E-04 to 1E-06 is consistent with the NCP and *Role of the Baseline Risk Assessment in Superfund Remedy Selection* (OSWER Directive 9355.0-30, April 22, 1991). These risk and hazard estimates were prepared using EPA's default exposure assumptions for commercial properties, which are hypothetical and do not reflect the actual work practices or potential exposures of the Amtrak workers at the Site now, in the past or in the future. In addition to the targeted soil removal, a site-wide engineered cover would be placed across the entire Site to significantly reduce the off-site migration of residual PCBs in surface soils and further limit the potential for direct contact exposure to this soil by future site workers. Although the soil excavation component of the Upland Soil remedial alternative targets soil removal to achieve an upper bound, cumulative cancer risk of less than 1E-04, the level of protection with the addition of the TSCA-equivalent caps and engineered covers will be significantly more protective since all areas will be capped or covered resulting in a site-wide upper bound, cumulative cancer risk significantly less than DNREC's Voluntary Cleanup Program (VCP) target of 1E-05 and a non-cancer hazard index of less than 1.0 for all constituents. This remedy will also include institutional and engineering controls to ensure this remedy is maintained into the future.

The remedial action goals for the Site limit the risk posed by site soils and sediments and limit potential future contamination of those sediments by site soils and LNAPL/groundwater in the subsurface. The risks may be reduced through pathway elimination or by removal of contaminated material to acceptable levels. Remedial action goals have been developed for soils, sediments and LNAPL/groundwater in the subsurface as discussed below:

- Soil: Protect human health by eliminating exposure to Site soils and to prevent direct contact of PCB soils with rainwater and surface water in order to further mitigate potential PCB loading to adjacent surface waters (Shellpot Creek). This will also reduce the risk associated with potential exposure to human receptors. In EPA's July 11, 2019 e-mail correspondence to Amtrak and Stantec, EPA stated that the remedial goal for the Maintenance Facility is "removal of >100 mg/kg PCBs or whatever excavation is necessary to not exceed a cumulative 1E-04 cancer risk or target organ hazard index of 1.0 for the standard outdoor worker". The Former Fueling Facility also targeted the removal of arsenic >300 mg/kg (however, arsenic is not a constituent of concern in the Maintenance Facility). As described in Section 1.7 and summarized in Section 2.3.2 below, TCE has been detected in soil to the east of the Administration Building and west and partially beneath, the Locomotive Shop. Soil removal in this area is not practical due utilities and building foundations this area. As a result, these soils are being addressed in-situ, through the ERD program (refer to Section 3.5) and the asphalt or concrete cover in this area will be maintained in accordance with the Long-term Stewardship Plan (LTS) for the Facility.

- Sediment: prevent direct contact between PCB sediments and surface water in order to further reduce PCB loading from the Site to Shellpot Creek and the Delaware River Estuary. This will also minimize exposure to opportunistic ecosystems that develop in the Site drainage features after implementation of the remedy.

- LNAPL/Groundwater: As described previously, efforts have been made to delineate, recover and contain LNAPL movement in the subsurface at the Site. As described in Section 2.1.3, the strategy for addressing groundwater within the Maintenance Facility considers the risk to human health, maintenance of IRMs as well as the ERD pilot test results and the natural biodegradability of the constituents of fuel oil. As described in Section 2.1.3, the remedial action objective for LNAPL/Groundwater is to remove the LNAPL to the extent practicable, continue the ERD activities and implement monitored natural attenuation to verify the reduction of dissolved hydrocarbons through natural processes. LNAPL mobility, fate and transport of dissolved groundwater constituents and ERD pilot test activities are described in Section 3.0.

2.3.2 Description of Impacted Media

This discussion pertains to soil, sediment and LNAPL/groundwater in the Outfall 002 drainage area and LNAPL/groundwater in the Outfall 007 area of the Maintenance Facility (sediments and soil in the Outfall 007 drainage area were addressed in the recommended remedy for the Former Fueling Facility).

Soil

Soils with detectable PCBs occur throughout the area of investigation. The Upland Soil remedial alternative described in the October 2019 RSFFS Addendum 2 for the Former Fueling Facility (DE-0266) targets soil excavation to achieve an upper bound, cumulative cancer risk of less than 1E-04 and a hazard index of less than 1.0 (by target organ system) after this targeted soil removal and before any additional remedial action. Soil removal areas are defined as tPCBs >100 mg/kg and arsenic >300 mg/kg (although arsenic was not detected at concentrations >300 mg/kg in the Maintenance Facility). The Upland Soil remedy for the Former Fueling Facility included soil removal targeted at tPCBs>100 mg/kg, TSCA-equivalent caps over tPCBs >50 to 100 mg/kg, and engineered cover over all remaining soils. The soil volumes/aerial extent for these target tPCB concentrations in the Maintenance Facility are summarized below:

- Volume of soil with PCB concentrations greater than 100 mg/kg = approximately 465 cubic yards,
- Extent of soil with PCB concentration greater than 50 mg/kg to 100 mg/kg = approximately 27,000 sq. ft (0.61 acres).
- Remaining areas (not under roof but including paved areas) = approximately 17 acres.

As described in Sections 1.7 and 1.8, elevated cVOCs, primarily TCE, have been detected in Site soils in an area between the Administration Building and the Locomotive Shop (refer to **Figure 1-56**). An enhanced reductive dechlorination (ERD) pilot test has been implemented in this area to address VOCs in soil and groundwater (refer to Section 3.5). In-situ treatment of cVOCs in soil in areas where cVOCs are under/immediately adjacent to building foundations and are not accessible for removal to meet the soil removal Remedial Goal would continue under the Long-Term Stewardship Plan (LTS) for the Facility.

Sediment

Sampling has shown evidence of PCBs in the sediments in the drainage ditch between the Outfall 002 outlet structure and Shellpot Creek. Two sediment samples collected in this drainage feature reported PCB concentrations of 3.9 mg/kg and 17.3 mg/kg (refer to Section 1.7, **Figure 1-51**). Sediment sample collection indicates that this feature has concrete base and sediment thickness is less than 0.5 feet. The extent of the sediment in this feature is approximately 4,000 sq. ft and the sediment thickness is up to 0.5 feet. The total estimated volume of sediments in this feature is approximately 74 cubic yards.

Sediments in the upper portion of the NED will be addressed in conjunction with sediment removal and stabilization of the lower NED. This remedy is described in the RSFFS and Addendums. Sediment sampling related to the upper portion of the NED is summarized in the IDS and additional sampling and analytical results were summarized in Section 1.7.3.

LNAPL/Groundwater

Groundwater investigations were summarized in Section 1.7. The occurrence of LNAPL in localized areas across the facility related to historic operations in is summarized below. These areas are:

- MH-14 Area: this area has been delineated using small diameter monitoring wells and is evaluated in the LNAPL conceptual site model (LCSM; refer to Section 3.3.3.1),
- Pit 17 Area at Building 7: LNAPL was identified in a service pit in relation to the wastewater investigations and has not been detected in groundwater on the water table in the area of Building 7,
- NY-MW-1 Area: LNAPL in this are appears to be isolated to NY-MW-1, and
- Locomotive Yard: LNAPL was identified in a track replacement project but was only detected (two occasions at apparent LNAPL thicknesses of 0.01 ft. and 0.02 ft) in one (NY-MW-8) of the six monitoring wells installed to assess LNAPL in the Locomotive Yard.

As described in Section 1.7, the primary constituents of concern in groundwater are cVOCs (primarily TCE and its degradation products such cis-1,2 DCE and VC). These constituents are believed to be associated with the historic operations in the vicinity and downgradient of the area east of the Administration Building and west of and beneath the Locomotive Shop. The fate and transport of cVOCs in this area has been evaluated using BIOCHLOR version 2.2 which is based on the Domenico (1997) analytical flow model (refer to Section 3.3.3.2). In addition, an enhanced reductive dechlorination (ERD) program was initiated to reduce cVOCs in the subsurface to the east of the Administration Building and adjacent to, and partially beneath, the Locomotive Shop to effectively treat the presumed source of the cVOCs in the subsurface (refer to Section 3.5).

Other constituents including PCBs, SVOCs and TAL-metals were identified in groundwater and are discussed in Section 1.7.2. However, due to absence of groundwater use in the area, the Facility location within the GMZ and the sporadic detection of these constituents above groundwater screening levels, these constituents will not require remedial action.

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

The following discussion provides identification of remedial response actions, identification and screening of remedial technologies and process options based on the technology screening provided in the RSFFS for the Former Fueling Facility. Media samples for the Maintenance Facility and Former Fueling Facility have been collected for analyses of PCBs, VOCs, SVOCs and metals. The primary contaminant of concern in the Maintenance Facility, as addressed by this RI/FFS, is PCBs. However, the localized occurrence of cVOCs in soil and groundwater will also be considered. Also included is a summary of treatability studies completed to-date.

PCBs have a low solubility in water and have a high tendency to sorb to soil and sediment particles. Transport of PCBs adsorbed to soils through soil erosion processes and transport of PCBs adsorbed to sediments in site ditches are the primary mechanisms of PCB mobility in the environment. Soil covering, capping, soil removal and implementation of erosion control and sediment reduction measures are effective technologies for reducing the mobility of PCBs associated with soils and preventing potential direct contact exposure to surface soils by human receptors. Ingestion of suspended solids containing PCBs at the lowest levels of the food chain may result in the biomagnification of PCBs in animal tissue at higher levels of the food chain. Engineered covers, capping and encapsulation remedies effectively block this exposure pathway at the lowest levels of the food chain and have proven to be very effective technologies to remediate PCB materials.

CVOCs (primarily TCE) has been reported in soils and groundwater at elevated concentrations in a localized area of the Maintenance Facility related to historic use. Based on site conditions including cVOC occurrence relative to Facility infrastructure, ERD was selected for bench-scale and field-scale pilot testing (refer to the ERD Pilot Test Work Plan; **Appendix 1-1**). Results of the ERD pilot testing to-date, indicate that this technology has been effective in addressing cVOCs in the subsurface (refer to Section 3.5). Therefore, ERD will be carried through the screening process as the primary technology for addressing cVOCs in the subsurface.

LNAPL containing PCBs on the groundwater table surface is another PCB migration mechanism at the Site. LNAPL has been recovered manually on a general monthly basis since 2008. Also, the LNAPL is weathered diesel fuel/fuel oil and the dissolved petroleum hydrocarbons degrade biologically under aerobic and anaerobic conditions indicating that monitored natural attenuation may be effective for this Site. Furthermore, based on sampling results, dissolved fuel oil related components are not considered constituents of interest in groundwater; this attributed to the residual fuel oil in the subsurface being weathered/heavy and/or the dissolved components are degradable, as well as the sporadic detection of these constituents above groundwater screening levels.

Based on the results of the site investigations and remedial action objectives, remedial action alternatives have been developed for the following media:

- Soil,
- Sediment in the site drainage ditches (drainage feature between Outfall 002 and Shellpot Creek), and
- LNAPL in the subsurface and groundwater.

3.1 General Response Actions

General response actions are classifications of general remediation methods that do not detail specific technologies. For the Wilmington Maintenance Facility, these include:

<u>No Action</u>
The no-action response is one in which the Site is left as it was found.

<u>Institutional Controls</u>
Institutional controls are those that limit exposure pathways, by restricting access to the contaminated property, without decreasing the concentration of the contaminant.

<u>Containment</u>
Containment is a physical barrier to limit exposure pathways while still allowing access to the remediated Site. It reduces mobility and exposure to both human and environmental receptors without decreasing the concentration of the contaminant.

<u>Treatment</u>
Treatment serves to limit exposure and transport by decreasing the concentration or toxicity of the contaminant through physical, biological, or chemical processes. Treatment may involve removal or in-situ processes.

<u>Removal and Disposal</u>
Removal limits exposure by completely removing contaminated material from the remediation Site. The material is then taken to appropriate disposal facilities.

<u>Monitoring of Site Conditions and Contaminant Levels</u>
Monitoring serves as the foundation for natural attenuation, in which the Site is closely observed through sampling and visual inspection.

3.2 Identification and Screening of Potentially Applicable Technologies

For each of the media that are found at the Maintenance Facility (soils, sediments, and LNAPL/groundwater), there are several appropriate potential treatment technologies. The USEPA Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (1988) determines general technology categories, such as containment or in-situ treatment, under which more specific technology process options can be classified for each type of medium. Other technologies needed to implement components of the selected response actions such as wastewater management, air emissions control and wetlands mitigation will be further considered in the remedial design phase. A listing of potentially applicable technologies is presented on **Table 3-1** and summarized in the discussion below.

3.2.1 Soil

3.2.1.1 Institutional Controls

Institutional controls consist of restrictions that limit the use and accessibility of the Site in order to preserve the integrity of the remediation installations and as a safeguard to continue to protect human and environmental health. These include:

- *Access Restrictions:* Access restrictions include controls such as fencing, signage, and security to prevent public trespassing that may lead to direct-contact exposure issues.
- *Deed Restrictions:* Deed restrictions, as prescribed by TSCA and Delaware UECA, notify future tenants of the Site to the remediation activities that occurred or may be ongoing.
- *Zoning Restrictions:* Any Site that falls into the City of Wilmington GMZ has zoning restrictions against the drilling of drinking water wells. Thus, there is an existing institutional control that prevents direct contact exposure to the groundwater at the Site. In addition, the Site is zoned industrial which is an institutional control limiting future development.

3.2.1.2 Containment

Containment provides a physical barrier to limit exposure pathways and contaminant mobility without decreasing its concentration or toxicity. Containment considered for site soils include engineered covers, capping and surface controls.

Capping or Engineered Covers

Contaminated soils are covered with a clean material, such as clean soil, sand, or concrete or asphalt. In-situ chemical additions may also aid in reducing or eliminating the bioavailability of contaminants of concern and/or slowing or preventing the contaminant movement. Covers of lower permeability are able to create an environment of physical isolation, reducing infiltration of rainwater. Many covers provide stabilization to prevent erosion that may lead to contaminant migration. Engineered cover and capping technologies include:

- *Asphalt/Concrete:* Asphalt and concrete are impervious surfaces that effectively limit the mobility of and exposure to the contaminant by reducing erosion of soils and eliminating direct contact. Asphalt or concrete provide a good surface for future building developments. Storm water controls can easily be incorporated into asphalt or concrete caps.

- *Geosynthetics:* Geosynthetic clay liners (GCL) limit rainwater from contacting soils, reducing soil erosion and eliminate direct exposure pathways.

- *Earth Cover:* An earthen cover of clean, low-permeability soil will eliminate any direct exposure pathway to surface soil while reducing erosion. For instance, an earthen cover of 10-12" in combination with GCL complies with 40 CFR 761.61.

- *Engineered Cover:* An engineered cover will eliminate direct exposure while reducing erosion. It includes various types of cover adapted to facility operations and implementability at specific locations and could be performed to eliminate direct exposure to surface soil while reducing erosion. The application of engineered covers will be consistent with facility operations in specific locations and will include any of the following:

    - Geotextile overlain by a minimum 6 inches of soil and seeding of soil,
    - Geotextile overlain by stone ballast (adjacent to track areas),
    - Surface water management controls including bioretention areas (grassed),
    - Roadways,
    - Asphalt or concrete (new) cover, and
    - Upgrade of existing asphalt, concrete or building cover, and
    - Maintenance/up-keep of all engineered covers (to be included in the Long-Term Stewardship Plan for the Facility).

Surface Controls

Surface controls reduce mobility and exposure without decreasing the concentration of the contaminant.

- *Erosion and Sediment Control:* Erosion and sediment controls limit mobility of the contaminant by preventing soil erosion that may enable PCB migration. Erosion and sediment controls considered for the Site include reinforced silt fencing, stone berms, and a stone driveway. These controls help prevent runoff from causing soil displacement, ensuring greater control over contaminant transport. Many controls involve water diversion to maintain the integrity of soils in high-risk areas.

3.2.1.3 Treatment

Treatment technologies include incineration, soil washing, chemical treatment, stabilization, and biological treatment.

- *Incineration:* Incineration involves heating impacted soils to high temperatures in order to volatilize, combust, and destroy organic compounds. High efficiency incinerators may be used to effectively handle soils with PCB concentrations in excess of 50 mg/kg. Types of incinerators include rotary kilns, circulating bed combustors, circulating fluidized beds, and infrared combustion. Incineration waste streams are composed of solid, water, and air residues.
    - Onsite: Incinerators used on-site are portable, scaled-down versions of rotary kilns or fluidized bed models.
    - Offsite: Excavated soils may be hauled off-site to be incinerated at approved public facilities. Low- and high-temperature facilities exist.

- *Soil Washing:* Many contaminants sorb to fine-grained soil particles. Soil washing is an ex-situ technique to chemically or physically remove contaminants from these soil particles. Soil is removed from the ground and the small, contaminated particles are size separated from larger, non-contaminated particles. The fine grains are then washed in a tank or treatment unit. Wash solutions employ various chemicals, including leaching agents, surfactants, and chelating agents, to remediate soils; some wash solutions instead use pH adjustments to remove contaminants. Contaminants are dissolved or suspended in solution and separated from sediments by gravity settling. The contaminant-concentrated solution is then disposed of and clean sediments are returned to their original location. Left over wash solution must be appropriately disposed.

- *Chemical Treatment:* chemical treatment technologies include the use of UV radiation and dechlorination.

- *UV Radiation:* UV radiation via mercury lamps, along with hydrogen peroxide and solvent, can transform PCBs into less toxic material through dehalogenation. The soils are removed and treated in slurry form, with the degraded PCB material ultimately separated from the soils. PCBs must be extracted from soils before irradiation can be carried out. The PCB slurry is irradiated in tubes (often quartz or a more durable plastic) to intensify the UV radiation in a flow-through reactor scheme. Studies of the photodechlorinaton process have shown greater than 95% dechlorination within an hour. Biphenyls, typical byproducts of dechlorination, were also shown to have been destroyed in the photodechlorination process. Another study has shown that very little energy (1.1 kWh) is required to achieve 99% dechlorination of Aroclor 1254 in an alkaline solution. UV radiation has also been shown to be easily modeled with pseudo first-order reaction kinetics, making for a simpler determination of the specific process to be used for a site.

- *Dechlorination:* The Dispersion Chemical Reaction (DCR) process, in tandem with a hydrophobized nucleophilic reagent, serves to immobilize and dechlorinate PCBs. DCR is one of many dechlorination processes used to remediate PCBs. Hydrophobized lime (CaO), achieved by adding fatty acids to CaO, can adsorb oils during mixing processes. Calcium hydroxide is produced and breaks into submicron parts. Reacting slowly with natural carbon dioxide (CO_2), calcium carbonate ($CaCO_3$) is formed. PCBs are then trapped in a $CaCO_3$ matrix, which prevents leaching of the contaminant. The hydrophobized nucleophilic reagent simultaneously dehalogenates the PCBs, rendering it less toxic as well as immobile. The compatibility and hydrophobic nature of the DCR product further aids in reducing leaching, by lowering the hydraulic conductivity of the soil and inhibiting the absorption of water. Lab studies have shown that upwards of 99% dechlorination is possible using the DCR method.

- *Stabilization:* Stabilization serves to bind soil particles to one another to reduce mobility of the impacted sediments and the PCBs adsorbed on the sediment also reducing bioavailability of PCBs and other contaminants. Binding is achieved by adding a pozzolanic material; for this Site, Quicklime, Portland cement, and bentonite have been examined. Portland cement produces a strong concrete-like material when stabilization is complete, whereas lime produces more low-strength cement-like material post-stabilization. Binding of soil particles decreases permeability of the soil, limiting contaminant migration and direct exposure pathways. Appropriate binder-to-soil ratios must be determined for successful implementation of stabilization as a remediation technique. Stabilization is sometimes enhanced with materials, such as activated carbon, to adsorb contaminants, more securely binding them in the stabilization matrix and preventing migration.

- *Biological:* A two-fold bacterial process is involved in biological remediation. Anaerobic and aerobic bacteria work in tandem to reduce the toxicity of contaminants. This partnership has been observed successfully reducing contaminants in waterways and other ecosystems. Anaerobic bacteria are capable of transforming highly chlorinated PCBs into less-chlorinated, less-toxic products. Meta- and para- chlorines are removed to produce ortho-substituted PCB congeners. The less-chlorinated byproducts, or lightly chlorinated congeners, can then be degraded by aerobic bacterial processes. For cVOCs, reductive dechlorination is a natural process in which native bacteria in soils and groundwater degrade dissolved-phase, chlorinated solvents in the environment. ERD may involve the introduction of engineered microorganisms or the addition of a carbon substrate in the presence of the required indigenous microorganisms to complete the dechlorination of cVOCs.

3.2.1.4 Removal and Disposal

Removal and disposal involve the excavation of the material from the subsurface. The material may be placed in on-site or off-site landfill.

- *Landfill (Offsite)***:** The soils would be excavated and transported off-site for disposal in an appropriate land disposal facility. Excavated soils with PCB concentrations in excess of 50 mg/kg would have to be disposed of in a TSCA-permitted landfill.

- *On-site Placement:* The soils would be excavated and contained on-site within a dedicated confined disposal facility or utilized as reagent material for stabilization activities.

3.2.1.5 Monitoring of Site Conditions and Contaminant Levels

A program of natural attenuation would be validated through monitoring of site conditions through soil, water, and air sampling.

3.2.2 *Sediments*

3.2.2.1 Institutional Controls

Institutional controls consist of restrictions that limit the use and accessibility of the Site in order to preserve the integrity of the remediation installations and as a safeguard to continue to protect human and environmental health. These include:

- *Access Restrictions:* Access restrictions include controls such as fencing, signage, and security to prevent public trespassing that may lead to direct-contact exposure issues.

- Deed Restrictions: Deed restrictions, as prescribed by TSCA and Delaware UECA, notify future tenants of the Site to the remediation activities that occurred or may be ongoing.

- *Zoning Restrictions:* Any site that falls into the City of Wilmington GMZ has zoning restrictions against the drilling of drinking water wells. Thus, there is an existing institutional control that prevents direct contact exposure to the groundwater at the Site. In addition, the Site is zoned industrial which is an institutional control limiting future development.

3.2.2.2 Containment

Containment provides a physical barrier to limit exposure pathways and contaminant mobility without decreasing its concentration or toxicity. Containment considered for site sediments includes ISS capping, covering and surface controls.

<u>Capping/Covering</u>

- Contaminated soils and sediments are covered with a material, such as sediment, sand, concrete or asphalt. In-situ chemical additions may also aid in slowing contaminant movement through more permeable caps. Caps or covers of lower permeability are able to create an environment of physical isolation, reducing the potential for rainwater coming in contact with soils. Many caps or covers provide stabilization to prevent erosion that may lead to contaminant migration.

- *Asphalt/Concrete:* Asphalt and concrete are impervious surfaces that effectively limit the mobility of and exposure to the contaminant by reducing erosion of sediments and eliminating direct contact. Asphalt or concrete provide a good surface for future development. Storm water controls can easily be incorporated into asphalt or concrete.

- *Geosynthetics and Riprap:* Geosynthetic clay liners (GCL) limit rainwater from contacting soils by reducing sediment erosion and eliminating direct exposure pathways. Riprap would provide an appropriate erosion control and anchoring mechanism for contact with aquatic environments.

- *Subaqueous Composite Reactive Caps:* Subaqueous composite caps include capping technologies which consist of a reactive media and permeable geotextiles. The reactive media may include granular activated carbon or organoclay. Activated carbon has a natural tendency to sorb to organics, including PCBs. Granular activated carbon may be incorporated into a mat or clay agglomerate cap, where the carbon may sorb to the PCBs, constricting migration. Similarly, organoclay is a material in which surface cations of the base, typically bentonite or hectorite, have been replaced with an organic molecule. The base material becomes hydrophobic, permeable, and more able to absorb organics and NAPLs. As an absorption media, the organoclay may be combined with a geotextile and placed over site sediments.

- *In-Situ Composite Aggregate Cap (AquaBlok® or similar technology):* In-situ composite aggregate (such as AquaBlok®) is a bentonite-coated capping product that is applied in a granular form to the water surface. The clay material settles on the sediment surface where the particles hydrate and coalesce forming a soft and relatively lowly permeable contact barrier over the sediments. The barrier also reduces the movement of dissolved material.

Vertical/Horizontal Containment

Vertical/horizontal containment are containment measures that provide a vertical or horizontal physical barrier to limit exposure pathways and contaminant mobility without decreasing its concentration or toxicity.

- *Slurry Walls:* Slurry walls are vertical structures that limit the mobility of the contaminant in sediment. The walls are installed via trenches excavated and filled low permeability material. Slurry walls have broad implementation and can eliminate the need to excavate or dispose of impacted sediment material.

- *Naturally Occurring Impermeable Features**:*** Naturally occurring impermeable features such as the clay layer beneath the site drainage features are considered barriers to the vertical movement of sediments and vertical migration of constituents from impacted site sediments.

<u>Surface Controls</u>

Surface controls reduce mobility and exposure without decreasing the concentration of the contaminant.

- *Sedimentation Basins:* Sedimentation basins allow for sediments to settle in isolation to prevent contaminant migration. The sedimentation basins would primarily serve to prevent off-site migration, and thus further on-site controls would need to be enacted to limit direct exposure pathways.

3.2.2.3 Treatment

Treatment technologies include incineration, chemical treatment, stabilization, and biological treatment.

- *Incineration:* Incineration involves heating dewatered impacted sediments to high temperatures in order to volatize, combust, and destroy compounds. High efficiency incinerators may be used to effectively handle sediments with PCB concentrations in excess of 50 mg/kg. Types of incinerators include rotary kilns, circulating bed combustors, circulating fluidized beds, and infrared combustion. Incineration waste streams are composed of solid, water, and air residues.

    - Onsite: Incinerators used on-site are portable, scaled-down versions of rotary kilns or fluidized bed models.
    - Offsite: Excavated sediments may be hauled off-site to be incinerated at approved public facilities. Low- and high-temperature facilities exist.

- *In-Situ:* In-situ treatment technologies include bioaugmentation, chemical oxidation, chemical reduction, and stabilization.

    - *Bioaugmentation:* Bioaugmentation involves the prescriptive addition of bacterial strains to sediment to enhance the degradation of PCBs. Based on the capabilities of microbes, specific strains may be chosen for specific degradation or transformation remedies. Halorespiring bacteria transform highly chlorinated PCBs to less chlorinated species, which are then susceptible to aerobic degradation. Bioaugmentation can decrease the mass of PCB contamination by 80% in 120 days, according to researchers at the Medical University of South Carolina and University of Maryland Baltimore County.

- *Chemical Oxidation:* Chemical oxidants, such as peroxide, ozone, and permanganate, are introduced to sediments to transform chemicals into less toxic products. Liquid hydrogen peroxide, when in the presence of Fe^{2+}, becomes a compound called Fenton's Reagent, which produces hydroxyl free radicals. These hydroxyls are nonspecific oxidants capable of rapid degradation of organics. Peroxide-based chemical oxidation requires an acidic environment, as the oxidant is degraded in more alkaline situations. Ozone also employs hydroxyl free radicals for oxidation and can also aid in oxygenation for the stimulation of other in-situ bioremediation processes that may accompany chemical oxidation. Permanganate applications are complex and thus are chosen less often. Chemical oxidation exhibits high efficiencies (greater than 90% organic degradation) and displays fast destruction rates (90% contaminant destruction in minutes). The hazardous nature of many oxidants. However, may lead to material handling issues.

- *Chemical Reduction:* Chemicals are added to sediments in order to create reducing environments which may transform or eliminate contaminants. Reducing agents are injected in liquid form or may be inserted as a solid media to passively treat contaminant plumes, often in the context of a permeable reactive barrier. Reducing agents are added to PCB sediments to produce biphenyls; in turn, the biphenyl byproducts can be transformed via catalytic hydrodechlorination into the more environment-friendly cyclohexylbenzene and bicyclohexyl, which can be recycled. However, nanoparticles produced in the process may be harmful to human health or the ecosystem.

- Stabilization: Stabilization serves to bind sediment particles to one another to reduce mobility. Binding is achieved by adding a pozzolanic material; for this Site, Quicklime, Portland cement, site soils/cinders and bentonite have been examined. Portland cement produces a strong concrete-like material when stabilization is complete, whereas lime produces more low-strength cement-like material post-stabilization. Binding of sediment particles decreases permeability, limiting contaminant migration and direct exposure pathways. Appropriate binder-to-sediment ratios must be determined for successful implementation of stabilization as a remediation technique. Stabilization is sometimes enhanced with materials, such as activated carbon, to adsorb contaminants, more securely binding them in the stabilization matrix and preventing migration.

3.2.2.4 Removal

Removal involves the excavation of the material from the subsurface. The material may be placed in on-site or off-site landfill.

- *Landfills (Off-site):* The PCB sediments would be excavated, dewatered, and transported off-site for disposal in an appropriate land disposal facility. Excavated sediments ≥ 50 mg/kg tPCBs would have to be disposed of in a TSCA-permitted landfill.

- *On-Site Placement:* The sediments would be excavated and contained on-site within a dedicated confined disposal facility. Alternatively, sediments can be stabilized and place on-site.

3.2.2.5 Monitoring of Site Conditions and Contaminant Levels

A program of natural attenuation would be validated through monitoring of site conditions through sediments, water, and air sampling.

3.2.3 LNAPL in the Subsurface and Groundwater

Subsurface investigations have targeted the delineation of LNAPL in the subsurface. LNAPL in the vicinity of Manhole 14 has been delineated using small diameter monitoring wells and is evaluated in the LNAPL conceptual site model (LCSM; refer to Section 3.3.3.1). Monthly manual LNAPL recovery began in 2008 and has continued generally on a monthly basis. Isolated LNAPL occurrence has also been identified in NY-MW-1 (west of the Locomotive Shop), in Pit 17 Area at Building 7 (LNAPL has not been detected in groundwater on the water table in the area of Building 7) and in NY-MW-8 (two occasions at thicknesses of 0.01 ft. and 0.02 ft) located in the Locomotive Yard.

The strategy for addressing LNAPL in the subsurface and groundwater includes applying the proposed remedial actions for the Former Fueling Facility as described in detail in the 2014 SFFS and included the recovery of LNAPL to the extent practicable followed by monitored attenuation of dissolved petroleum hydrocarbons in groundwater. The Agencies agreed in concept with this approach in DNREC's May 17, 2015 letter (related to the Former Fueling Facility) providing certain conditions were met (to be discussed further in Section 3.3.3). As stated in the May 17, 2015 letter, Agency approval will require: 1) natural attenuation modeling to demonstrate that dissolved contaminants will degrade to an acceptable industrial level in a reasonable timeframe (approximately 20 years or less) and 2) vapor barriers will be a necessary component of any new construction. The potential response actions for LNAPL in the Maintenance Facility are similar to those described in the RSFFS for the Former Fueling Facility.

<u>LNAPL</u>

- LNAPL Recovery: Manual LNAPL removal has been conducted in the Maintenance Facility at locations demonstrating measurable LNAPL thicknesses since approximately 2008 (recovered LNAPL is transported to a recovery tank in the Former Fueling Facility for eventual incineration at a TSCA facility). Apparent LNAPL thicknesses and extent has not warranted the installation of an active LNAPL recovery system. Section 3.3.3.1 presents the LNAPL Site Conceptual Model (LCSM). Estimates of LNAPL transmissivity and recoverability indicate that the LNAPL is not practicably recoverable (refer to Section 3.3.3.1 and **Appendix 3-1**).

- Monitored Natural Attenuation: Monitored natural attenuation will be performed to track the natural biodegradation of the dissolved diesel fuel components once the target criteria LNAPL recovery have been met. The LCSM demonstrates that the LNAPL plume in the MH-14 area is not mobile and is stable or shrinking (refer to Section 3.3.3.1 and **Appendix 3-1**). Also, the LCSM describes that the dissolved phase groundwater sampling results indicate that the LNAPL likely has low effective solubility for VOC and SVOC constituents. Additionally, the lack of an expanding groundwater plume further indicates that the LNAPL is not migrating (i.e. is not mobile).

<u>Groundwater</u>

As described in Section 1.7, the primary constituents of concern in groundwater are cVOCs (primarily TCE and its degradation products such as cis-1,2 DCE and VC). These constituents are believed to be associated with the historic operations in the vicinity and downgradient of the area east of the Administration Building and west of and beneath the Locomotive Shop.

A scope of work (the January 2018 Interim Remedial Measures Work Plan) was developed to target groundwater in the area between the Administration Building and the Locomotive Shop where the highest concentrations of TCE have been detected. By reducing TCE concentrations in the presumptive source area, groundwater concentrations will also be reduced downgradient of this area through natural processes. Bench-scale pilot testing was performed for the development of an appropriate interim remedial measure in order to address the presumed source of TCE in soil, groundwater and basement sump water.

Considering that the likely cVOC source area is partially below a building (Locomotive Shop) and the extent of subsurface utilities in the area, implementation of ERD in-situ through the augmentation of the subsurface conditions with an electron donor solution (carbon source) is applicable to site subsurface conditions. As mentioned, review of groundwater analytical data collected indicates that natural dechlorination processes are occurring (as indicated by the occurrence of TCE daughter products cis-1,2-DCE and vinyl chloride). Also, boring logs from the area suggest that subsurface materials above the clay layer are sufficiently permeable to allow for the addition and distribution of an electron donor solution.

- Reductive dechlorination is a natural process in which native bacteria in soils and groundwater degrade dissolved-phase, chlorinated solvents in the environment. In this process, the chlorinated solvent serves as an electron acceptor (or weak oxidizing agent) that is reduced by reactions with other chemicals in the groundwater that serve as electron donors. Typical electron donors include natural organic carbon, dissolved hydrocarbon gases and dissolved hydrogen. The available electron donors must be capable of driving the desired biochemical reactions without interferences from other electron acceptors. Typically, reductive dehalogenation is limited by the lack of a carbon substrate that the microbes use for energy and removal of other competing electron acceptors (nitrate, sulfate, etc.). Enhanced reductive dechlorination (ERD) involves the addition of a carbon substrate in the presence of the required microorganisms and can result in the complete dechlorination of cVOCs. Bench-scale and field-scale pilot testing of ERD at the Maintenance Facility is described in Section 3.5.

- Monitored Natural Attenuation: Monitored natural attenuation is performed to track the attenuation, natural biodegradation and other fate and transport processes related to dissolved constituents in groundwater. As mentioned, the LCSM includes an evaluation of dissolved hydrocarbons related to LNAPL occurrence and mobility (refer to Section 3.3.3.1). Also, groundwater fate and transport attenuation modeling has demonstrated that the dissolved cVOC groundwater plume will continue to diminish under natural conditions (refer to Section 3.3.3.2), although ERD has been implemented to enhance natural processes.

3.3 Evaluation of Potential Remedial Technologies

The potential remedial technologies will be evaluated for their applicability to the Site and the most appropriate technologies for the site conditions and remediation goals will be assembled into remedial alternative combinations. To determine which remedial technologies should be considered for inclusion in the remedial alternatives, each technology will be evaluated using three criteria:

Effectiveness

Effectiveness describes how well a technology performs in achieving remedial action objectives and how effective and reliable it is in reducing hazards associated with the contaminant.

Implementability

Implementability describes how feasible it is to employ certain technologies at the Site. It includes many concerns involved with the actual use of a technology at the Site, including:

- Construction and operation feasibility,
- Potential human and environmental health consequences, and
- Material handling issues.

Cost

Cost plays a significant role in the ultimate decision-making process for the remediation of a Site. Costs will be kept in mind for long-term feasibility of a certain technology, but the cost of an option will not be a significant factor in the screening process. Therefore, unless the cost is exorbitant and plays a major role in the selection of a technology, it will not be a significant factor at this point in this screening process.

3.3.1 Soil

3.3.1.1 Institutional Controls

- Effectiveness: Institutional controls serve to restrict access to or future development/use of the Site. They do not involve mitigation of the contaminant. They do provide protection from direct-contact exposure pathways and protection to future tenants of the Site and often are used in conjunction with engineering controls such as covering and capping.
- Implementability: Institutional controls are easily implementable and are necessarily so. Access restrictions can be implemented on the Site, but if redevelopment takes place, access may not be completely restricted. Deed and zoning restrictions are required by law and must be implemented. There are almost no construction or operation concerns with such an option.
- Conclusion: Institutional controls will be included as an enhancement of the technologies retained for inclusion in the remedial alternative assemblages.

3.3.1.2 Containment

Asphalt/Concrete Cap or Cover

- Effectiveness: Asphalt and concrete are very effective in the containment of soils and reduction of contaminant migration and preventing direct contact exposure to surface soils by human or environmental receptors.

- Implementability: Asphalt and concrete are widely used construction materials and are both readily available and easy to install and maintain. The use of asphalt and concrete caps at the Site will be especially appropriate, as they provide effective barriers to direct contact exposure.

- Conclusion: Asphalt and concrete covering or capping will continue to be an option retained for inclusion in the remedial alternative assemblages.

Geosynthetic (GCL) Caps/Geotextiles

- Effectiveness: Geotextiles are effective in the containment of contaminants and the reduction of contaminant migration.

- Implementability: Geotextiles are widely used materials and are fairly easy to install. Geotextiles can be reinforced to provide appropriate foundation for future building developments or may be covered with earth and re-vegetated.

- Conclusion: Geotextiles will be retained for inclusion in the remedial alternative assemblages.

Earth Cover

- Effectiveness: Earthen covers are effective at preventing direct contact exposure to and migration of contaminants in surface soil when the proper depth and compaction are employed. This contaminant prevents many direct exposure scenarios, but the soil cover may become eroded or disturbed and needs to be maintained.

- Implementability: With enough available soil, this option is feasible for the Site. It is an appropriate natural remedy that would be easy to implement and maintain should future repairs become necessary.

- Conclusion: The earthen cover is retained for inclusion in the remedial alternative assemblages, especially in conjunction with geotextile covers as an additional remediation control.

Engineered Cover

- Effectiveness: As mentioned, engineered covers include asphalt, concrete, geotextiles, earthen and other covers that are effective at preventing direct contact with surface soil and migration of contaminants in surface soil when properly employed.

- Implementability: Since engineered covers will be adapted to facility operations at specific locations, this option is feasible for the Site. It is an appropriate remedy that would be easy to implement and maintain should future repairs become necessary.

- Conclusion: The engineered cover is retained for inclusion in the remedial alternative assemblages.

Surface Controls (Erosion and Sediment Control)

- Effectiveness: When used as a supplement to other remedial technologies, erosion and sediment control measures can prove very effective in reducing erosion and limiting runoff reaching the remediated areas.

- Implementability: There are currently basins on the Site to help detain storm water. Additional storm water controls, including a new detention pond and run-on ditches, are being considered for the remediated Site.

- Conclusion: The inclusion of storm water controls will be maintained for inclusion in the remedial alternative assemblages in conjunction with other remediation technology options.

3.3.1.3 Treatment

Incineration

- Effectiveness: Incinerators are effective at removing PCBs from impacted soils or treatment option for this Site. They must meet technical standards in order to be used for remediation.

- Implementability: Incinerators have been used in the remediation of PCB-impacted materials. Although a relatively expensive treatment, incineration may be implemented on-site or off-site. On-site implementation issues include construction cost, construction time, harmful air emissions, and permitting. The Site would most likely have a difficult time obtaining permits to incinerate on-site due to the volume of soils containing PCBs. Off-site implementation issues include material handling and transportation. In addition to these concerns, incineration of soils with high metal content can produce extremely toxic air environments around the incineration apparatus.

- Conclusion: Incineration will not be maintained as a standalone technology. Off-site disposal technologies may be evaluated in a remedial design phase relative to the selected remedial action(s).

Soil Washing

- Effectiveness: Soil washing is effective in removing contaminants from soil particles.

- Implementability: Soil washing requires that soil be removed from the ground and sent through a washing apparatus, which mixes the soil with reagents designed to extract the PCBs from the soil. The process of removing, washing, and replacing soil can be a lengthy one that involves material handling issues. The process may also require emission controls and additional permitting. Furthermore, the washing solvent containing the removed PCBs may prove difficult to handle, transport, and dispose.

- Conclusion: Soil washing will not be retained as a treatment option for this Site.

Chemical Treatment

UV Radiation:

- Effectiveness: Photolysis via UV radiation is effective at degrading halogenated compounds like PCBs. The PCBs absorb photons from the light source, promoting oxidation, which transforms them into a less chlorinated, less toxic compound.

- Implementability: UV photolysis requires removing the soil from the ground, treating it, and replacing it. Aside from handling issues, UV radiation requires large and expensive equipment.

- Conclusion: UV radiation is not retained as a treatment option for this Site.

Dechlorination:

- Effectiveness: Although this is an effective treatment in lab and pilot studies, it has not been proven in large-scale settings for PCBs.

- Implementability: While this technology needs to be further studied for effectiveness, it is a closed system not proven in large-scale settings.

- Conclusion: As this technology is not proven and may be costly, it will not be retained for inclusion as treatment option for the Site.

Stabilization

- Effectiveness: Stabilization is a proven effective treatment for PCB contamination. PCBs have a high affinity to adsorb to soil, which makes the stabilization of the soil particles especially effective in further immobilizing the PCBs.

- Implementability: The stabilization practice does not require soil removal since the process can be completed in-situ and poses few materials handling issues. Successful treatability studies have been performed to assess the performance of stabilization at the Site (refer to Section 3.5 of the RSFFS).

- Conclusion: Stabilization will be retained as a treatment option for inclusion in the remedial alternative assemblages.

Biological Degradation

- Effectiveness: Biological degradation of PCBs is not proven to be exceptionally effective in large scale on-site soil applications. Bench-scale and field scale-pilot tests have proven the ERD is effective for the treatment of cVOCs in the subsurface at the Site.

- Implementability: Biodegradation for PCBs often requires soil piling for proper oxygen, introducing bacteria strains and nutrient delivery. Bench-scale and field scale-pilot tests have proven the presence of the necessary indigenous bacteria and ability to distribute electron donor solution to effectively implement ERD to address cVOCs in the subsurface.

- Conclusion: This technology will not be retained as a treatment option for PCBs but will be retained for cVOCs at this Site.

3.3.1.4 Removal

- Effectiveness: Removal would eliminate soil containing PCBs above a certain concentration from the Site.

- Implementability: Excavation is a well-established practice. Given that the Site is an active rail yard, depending on the extent of the excavation, significant areas of active track could be affected which would make implementation of this work impractical. Transporting and disposing of PCB soils may present materials handling, emissions, and safety issues.

- Conclusion: Excavation will be retained as a technology option in the remedial alternative assemblages.

Landfills (off-site)

- Effectiveness: Transport of PCB material to off-site TSCA-approved landfills would eliminate soils containing PCBs above a certain threshold from the Site.

- Implementability: Landfill disposal is implementable and is widely used as a remediation alternative. Transport of PCB material to off-site landfills may raise material handling issues. Because there are only limited public permitted landfills in the country able to accept the waste, transporting the material may involve extremely long distances that generates other pollution associated with motor vehicle emissions and the truck traffic entering and exiting the facility may cause local issues.

- Conclusion: Off-site landfill disposal will be retained for inclusion in the remedial alternative assemblages.

On-site Placement

- Effectiveness: Containment of PCB materials in an on-site confined facility would eliminate direct-contact exposure pathways. PCB materials would still be on-site, however, and may pose challenges to future use of the Site.

- Implementability: On-site landfill disposal is implementable, as no transportation of PCB materials is required.

- Conclusion: On-site placement will be retained for inclusion in the remedial alternative assemblages, as it is similar in nature to capping or covering of impacted materials, but involves unnecessary extra construction, excavation, and time.

3.3.1.5 Monitoring of Site Conditions and Contaminant Levels

- Effectiveness: Monitoring of site conditions and contaminant levels aids in the validation of natural attenuation, tracking its progress. Monitoring of site conditions and contaminant levels can ensure effectiveness of any course of remediation treatment.

- Implementability: Monitoring is easy to implement, and in many cases, it is required in order to comply with regulations and permits.

- Conclusion: Monitoring will not be retained as a standalone technology for soil, it will be incorporated with other treatment technologies for a more complete remedial alternative solution.

3.3.2 Sediments

3.3.2.1 Institutional Controls

- Effectiveness: Institutional controls serve to restrict access to or future development/use of the Site. They do not involve mitigation of the contaminant. They do provide protection from direct-contact exposure pathways and protection to future tenants of the Site and are often used in conjunction with engineering controls such as covering and capping.

- Implementability: Institutional controls are easily implementable and are necessarily so. Access restrictions can be implemented on the Site, but if redevelopments take place, access may not be completely restricted. Deed and zoning restrictions are required by law and must be implemented. There are almost no construction or operation concerns with such an option.

- Conclusion: Institutional controls will be included as an enhancement of the technologies retained for inclusion in the remedial alternative assemblages.

3.3.2.2 Containment

Asphalt/Concrete Cap

- Effectiveness: Asphalt and concrete are very effective in the containment of sediments and reduction of contaminant migration.

- Implementability: Asphalt and concrete are widely used construction materials and are both readily available and easy to install and maintain. The use of asphalt and concrete caps at the Site provide effective barriers to direct contact exposure.

- Conclusion: Asphalt and concrete capping will continue to be an option retained for inclusion in the remedial alternative assemblages.

Geotextile Cap with Riprap

- Effectiveness: Geotextiles are effective in the containment of contaminants and provide appropriate aquatic contact surfaces in conjunction with riprap.

- Implementability: Geotextiles and riprap are widely used materials and are fairly easy to install.

- Conclusion: Geotextile caps with riprap will be retained for inclusion in the remedial alternative assemblages.

Subaqueous Composite Reactive Caps

- Effectiveness: Activated carbon or organoclay composite caps are effective at absorbing hydrocarbons contained in the sediments. The technology is permeable and the water passing through the media may contain dissolved hydrocarbons as well as PCBs.

- Implementability: Reactive caps have proven effective in pilot studies but have not been widely implemented at real remediation Sites. Activated carbon and organoclay is easily incorporated into a number of implementable caps, mats, and agglomerates. Considering the consistency of the sediments at this Facility, it will likely be necessary to dewater the drainage ditches and/or treat water during implementation since sediments will likely become re-suspended during installation.

- Conclusion: Subaqueous composite reactive caps will not be retained as a technology option in the remedial alternatives.

In-Situ Composite Aggregate Cap (AquaBlok® or similar technology)

- Effectiveness: AquaBlok® appears to be a potentially effective means of providing a barrier over impacted sediments and limiting dissolved phase transport (bench-scale testing is described in Section 3.5 of the RSFFS).

- Implementability: AquaBlok® can be applied through the water column such that dewatering prior to capping is not needed. It is relatively easy to implement in comparison to other capping scenarios.

- Conclusion: Installation of AquaBlok® will not be retained as a technology option in the remedial alternatives, largely due to the relatively small volume of impacted sediments and other more permanent alternatives.

Vertical/Horizontal Containment

- Effectiveness: Vertical/horizontal contaminant barriers are effective at preventing horizontal or vertical migration and provide isolation of contaminants due to their low permeability. Naturally occurring impermeable features such as the underlying clay layer are effective in preventing the vertical migration and provide isolation of contaminants due to their low permeability.

- Implementability: Vertical/horizontal contaminant barriers are implementable at a wide range of sites. Different available wall materials provide different containment levels. For example, the construction of groundwater barrier walls is proven and carried out at many Sites, including at construction Sites to prevent groundwater intrusion, and thus would not be difficult to install. There is an existing concrete substrate at the base of the Outfall 002 drainage ditch.

- Conclusion: Vertical/horizontal contaminant barriers are effective at preventing horizontal or vertical migration and provide isolation of contaminants due to their low permeability. The Outfall 002 drainage ditch is underlain by concrete.

Surface Controls (Sedimentation Basins)

- Effectiveness: Sedimentation basins may prove effective in remediating the PCB sediment in that they isolate the sediment and allow time for separation and degradation to occur.

- Implementability: Sedimentation basins do not eliminate direct exposure pathways and require a large amount of space to implement effectively.

- Conclusion: Sedimentation basins will not be retained as a technology option in the remedial alternative assemblages.

3.3.2.3 Treatment

Incineration

- Effectiveness: Incinerators are effective at destroying PCBs in sediments. They must meet technical standards in order to be used for remediation.

- Implementability: Incinerators have been used in the remediation of PCB materials. Although a relatively expensive treatment, incineration may be implemented on-site or off-site. On-site implementation issues include construction cost, construction time, harmful air emissions, and permitting. This Site would most likely have a difficult time obtaining permits to incinerate on-site due to the volume of the material on-site. Off-site implementation issues include material handling and transportation. In addition to these concerns, incineration of sediments can produce extremely toxic air environments around the incineration apparatus.

- Conclusion: Incineration will not be maintained as a standalone technology. Off-site disposal technologies may be evaluated in a remedial design phase relative to the selected remedial action(s).

Stabilization

- Effectiveness: Stabilization is a proven effective treatment for PCB contamination in sediments. PCBs tend to sorb to sediments, which makes the stabilization especially effective in immobilizing the PCBs. The in-situ stabilization pilot testing performed in the Eastern Drainage Ditch for the Former Fueling Facility indicated that the technology is effective (refer to Section 3.5 of the Former Fueling Facility RSFFS).

- Implementability: The stabilization practice does not require sediment removal (i.e. In-situ processes) and poses few materials handling issues. Successful treatability studies have been performed to assess the performance of stabilization at the Site (refer to Section 3.5 of the Former Fueling Facility RSFFS).

- Conclusion: Stabilization will be retained as an option for inclusion in the remedial alternative assemblages.

In-Situ Treatment

Bioaugmentation:

- Effectiveness: Bacteria have been shown to reduce the mass of PCB contamination by 80% in 120 days. Bacteria have the ability to degrade the PCBs into less toxic species. However, this process has not been proven in large-scale field applications.

- Implementability: Bioaugmentation effectiveness claims are based on lab studies and not proven in field applications.

- Conclusion: Bioaugmentation will not be retained as a technology option in the remedial alternative assemblages.

Chemical Oxidation:

- Effectiveness: Oxidation can transform PCBs into less toxic materials. However, many oxidants are still in the development stage.

- Implementability: Chemical oxidation is a process that may or may not require removal of sediments, but there are several types of oxidants and choosing the right one and the proper dosage can prove challenging. Oxidants also may prove difficult to inject and have short in-ground persistence, which may limit their treatment capabilities. Oxidants are also hazardous to human health and may pose material handling issues.

- Conclusion: Chemical oxidation is not retained as a technology option for the remedial alternative assemblages.

Chemical Reduction:

- Effectiveness: Chemical reduction not only reduces the chlorination of PCBs; it can also produce environmentally friendly byproducts when performed in conjunction with catalytic dechlorination.

- Implementability: Reducing agents can be applied in-situ. The dehalogenation process may produce nanoparticles which may be harmful to human health and the ecosystem. Effective contact with sediments or injection of reagents may be difficult.

- Conclusion: Chemical reduction will not be retained as a technology option.

3.3.2.4 Removal/Excavation

- Effectiveness: Removal could eliminate PCBs in sediment above a certain concentration from the Site.

- Implementability: Excavation is a well-established practice. Transporting and disposing of sediments containing PCBs may present materials handling issues.

- Conclusion: Excavation will be retained as a technology option in the remedial alternative assemblages.

Off-Site Landfills

- Effectiveness: Transport of PCB material to off-site TSCA-approved landfills would eliminate PCBs in sediments above a certain threshold from the Site.

- Implementability: Landfill disposal is implementable and is widely used as a remediation alternative. Transport of PCB material to off-site landfills may raise material handling issues. Because there are only limited public permitted landfills in the country able to accept the waste, transporting the material may involve extremely long distances that generates other pollution associated with motor vehicle emissions and the truck traffic entering and exiting the Facility may cause local issues.

- Conclusion: Off-site landfill disposal will be retained for inclusion in the remedial alternative assemblages.

On-site Placement

- Effectiveness: Containment of PCB materials in an on-site landfill would eliminate direct-contact exposure pathways. PCB materials would still be on-site, however, and may pose challenges to use of the Site.

- Implementability: On-site landfill disposal is implementable, as no transportation of PCB materials is required.

- Conclusion: On-site placement in a confined facility will be retained for inclusion in the remedial alternative assemblages, as it is similar in nature to capping of PCB materials.

3.3.2.5 Monitoring of Site Conditions and Contaminant Levels

- <u>Effectiveness:</u> Monitoring of site conditions and contaminant levels aids in the validation of natural attenuation, tracking its progress and effectiveness of the remediation treatment.

- <u>Implementability</u>: Monitoring is easy to implement, and in many cases, it is required in order to comply with regulations and permits.

- <u>Conclusion:</u> Monitoring will not be retained as a standalone technology; it will be incorporated with other treatment technologies for a more complete remedial alternative solution.

3.3.3 LNAPL in the Subsurface and Groundwater

The remedial alternatives for LNAPL and groundwater in the Maintenance Facility also consider Agency comments pertaining to LNAPL and groundwater in the Former Fueling Facility (DE-0266). In DNREC's March 17, 2015 letter (pertaining to the Former Fueling Facility), the Agencies accepted the concept of removal of the LNAPL to the extent practical and MNA of the dissolved groundwater compounds. As stated in the letter, Agency approval will require: 1) natural attenuation modeling to demonstrate that dissolved contaminants will degrade to an acceptable industrial level in a reasonable timeframe (approximately 20 years or less), and 2) vapor barriers will be a necessary component of any new construction.

Vapor barriers have been installed for recent fixed occupied building construction recently installed in the groundwater study area as a precaution. As examples, the recently constructed ACS-64 Test/Warranty Building, Car Shop Relocation Building, and Building 15.1 were constructed with vapor barriers as precautionary measures.

In order to address the remaining Agency requirements, additional evaluations of LNAPL migration and further recoverability and MNA of dissolved constituents in groundwater were performed. These evaluations are described below.

3.3.3.1 LNAPL Conceptual Site Model

A Light Non-Aqueous Phase Liquid (LNAPL) Conceptual Site Model (LCSM) was prepared to provide an assessment of LNAPL mobility and recoverability at the Manhole 14 area of the Maintenance Facility. *Light Non-Aqueous Phase Liquid Conceptual Site Model, Amtrak Wilmington Maintenance Facility* (Stantec, 2019a) is included in **Appendix 3-1**.

The LCSM uses terminology consistent with the DNREC Regulations Governing Underground Storage Tank Systems (2016) and methods consistent with Interstate Technology Resource Council (ITRC, 2009). The LCSM provides an assessment of LNAPL mobility to support the evaluation of potential risk associated with the presence of LNAPL in the subsurface based on data collected within the Maintenance Facility groundwater study area. Field and laboratory testing have been performed for use in providing data for the evaluation of LNAPL mobility and recoverability.

The discussion of LNAPL mobility and recoverability presented in the LCSM includes use of:

1) analysis of apparent LNAPL thickness,
2) observations over time of LNAPL distribution,
3) physical and chemical laboratory analysis of the LNAPL,
4) the history of LNAPL sources and recovery,
5) estimates of LNAPL transmissivity, and
6) theoretical estimates of LNAPL mobility supported by field and laboratory measurements to understand the potential mobility of the LNAPL plume.

The emerging consensus in technical approach to understanding LNAPL behavior is to use a combination of these methods to evaluate LNAPL mobility based on multiple lines-of-evidence with the primary emphasis on observational data at wells and field tests to evaluate LNAPL presence and mobility. Based upon the discussion presented in the LCSM (**Appendix 3-1**), the remaining residual LNAPL at the Site is generally limited in extent, stable (not mobile), increasingly viscous and weathered, and not practicable to recover via traditional methods.

Based upon the multiple lines of evidence, the LNAPL present at the Site does not appear to be migrating; the extent of LNAPL is delineated and the extent of free LNAPL has reduced or remains stable over time. Also, estimates of LNAPL transmissivity and recoverability indicate that the LNAPL is not practicably recoverable. A detailed description of the methods, site-specific data and results of the LCSM are presented in **Appendix 3-1**.

3.3.3.2 Groundwater Fate and Transport

Groundwater fate and transport modeling was performed to predict and evaluate the potential migration of dissolved constituents in groundwater in the vicinity and downgradient of the area east of the Administration Building and west of and beneath the Locomotive Shop within the Maintenance Facility. *BioChlor Technical Memo* (Stantec 2019b), included in **Appendix 3-2**, documents the activities performed to develop the groundwater model, translate the hydrogeologic conceptual model into a numerical model, calibrate the model, construct a contaminant transport model, conduct predictive simulations and develop conclusions.

The selected groundwater flow model utilized for this study was BIOCHLOR version 2.2 which is based on the Domenico (1997) analytical flow model. BIOCHLOR is programmed in Microsoft Excel and is available from the Environmental Protection Agency (EPA). The Domenico Model calculates the concentration of cVOCs at any point and time down gradient of a source area of known extent and magnitude. In this analysis, the effects of advective transport, sorption and first order decay were evaluated to determine the natural attenuation of TCE with distance from the highest observed value at the Site (presumed source area). The *BioChlor Technical Memo* presents the methodology used to derive each of the parameters used to conservatively estimate TCE, DCE and VC concentrations downgradient of the source area and develop a source area target level.

The calibrated model was used to conservatively estimate plume lengths (as defined by concentrations above HSCA Screening Levels) for TCE, DCE and VC. The plume lengths were conservatively simulated in the absence of source reduction. The results indicated that plumes would extend less than 225 feet, 275 feet, and 335 feet downgradient from the source area, for TCE, DCE and VC, respectively (**Appendix 3-2**, Figures 4, 5 and 6). The model predicts that the cVOC groundwater plume associated with the Locomotive Shop source area, would not reach the property boundary at concentrations above HSCA Ground Water Screening Levels for TCE, DCE and VC even without the application of ERD.

3.3.3.3 Evaluation of LNAPL and Groundwater Potential Remedial Technologies

Based on review of the LCSM and the fate and transport modeling described above, LNAPL recovery to the extent practicable and monitored natural attenuation of dissolved hydrocarbons in groundwater have been evaluated using the three criteria previously described (effectiveness, implementability and cost). As mentioned previously, at this point in the screening the cost of an option will not be a significant factor in the screening process. Therefore, unless the cost is exorbitant and plays a major role in the selection of a technology, it will not be a significant factor at this phase of the screening process.

LNAPL

Recovery to the Extent Practicable

- Effectiveness: As described above, the LCSM presents multiple lines of evidence supporting that LNAPL present at the Site does not appear to be migrating; the extent of LNAPL is delineated and the extent of free LNAPL has reduced or remains stable over time. Also, estimates of LNAPL transmissivity and recoverability indicate that the LNAPL is not practicably recoverable.

- Implementability: Manual LNAPL recovery has been performed generally on a monthly basis since 2008. Active LNAPL recovery was not implemented due to minimal and stable apparent LNAPL thicknesses.

- Conclusion: Based on the results of the LCSM, LNAPL recovery to the extent practicable has been attained (monitoring of LNAPL occurrence will be included in the monitored natural attenuation program).

LNAPL (and Groundwater)

Monitored Natural Attenuation

- Effectiveness: Site monitoring data has documented the occurrence of natural degradation and attenuation processes in groundwater. The LCSM indicated that the dissolved LNAPL components are not considered mobile and have low solubility in the subsurface. Groundwater fate and transport modeling has demonstrated that the extent of the dissolved cVOC plume will continue to diminish.

- Implementability: Easy to implement; an extensive monitoring network is currently in place.

- Conclusion: Monitored natural attenuation will be retained.

Groundwater

Enhanced Reductive Dechlorination (ERD)

- Effectiveness: Bench-scale and field-scale pilot testing of ERD at the Maintenance Facility is described in Section 3.5. The results of the ERD program indicate that ERD is effective in reducing cVOC concentrations in groundwater. Performance monitoring will assess the long-term effectiveness.

- Implementability: Efficient to implement; the ERD electron donor solution addition wells have been installed and the associated solution addition equipment has been assembled.

- Conclusion: Enhanced reductive dechlorination will be retained.

3.4 Summary of Treatment Technologies and Selection of Representative Process Options

The selection of general response actions is summarized on **Table 3-2**. Consistent with Agency comments to the RSSFS and RSFFS Addendum 1 for the Former Fueling Facility and considerations unique to the Maintenance Facility, the following treatment technologies have been retained for inclusion in the remedial alternatives:

Soil

- *Institutional Controls* – all retained as enhancements to other process options within the remedial alternatives.

- *Capping or Covering* – asphalt/concrete and geotextile/earth caps or covers are retained for inclusion in remedial alternatives.

- *Erosion and Sediment Controls* – all retained as enhancements to other process options within the remedial alternatives.

- *Excavation* – excavation with both on-site and off-site disposal will be retained for the remedial alternatives.

- *Biological Treatment (for cVOCs)* - the area of elevated TCE concentrations (in the ERD pilot test area) is underlain by numerous subsurface utilities, rail tracks, building foundations and other subsurface obstructions. As such, soil excavation is not practical in these areas. Also, the ERD process has been demonstrated to be effective in this area (refer to Section 3.5). ERD will continue in association with the groundwater remedy for this area.

Monitoring of site conditions will not be retained as a standalone technology; it will be incorporated with other treatment technologies for a more complete remedial alternative solution. Also, incineration will not be maintained as a standalone technology. Off-site disposal technologies may be evaluated in a remedial design phase relative to the selected remedial action(s).

Sediments

- *Institutional Controls* – all retained as enhancements to other process options within the remedial alternatives.

- *Removal* – considering the relatively small volume of sediments (approximately 75 cubic yards), sediment removal will be retained for the remedial alternatives.

Monitoring of site conditions will not be retained as a standalone technology; it will be incorporated with other treatment technologies for a stronger and more complete remedial alternative solution. Also, incineration will not be retained as a standalone technology. Stabilization of the removed sediments will be retained and considered in association with the sediment remedy for the Former Fueling Facility. The Outfall 002 drainage ditch has a concrete base; removal of sediments to the concrete base will be effective. The placement of riprap above the concrete base will be considered in design phase relative to the selected remedial action(s).

LNAPL/Groundwater

- *Enhanced Reductive Dechlorination:* ERD will be retained based on the results of the ERD pilot testing.

- *Monitored Natural Attenuation:* Monitored natural attenuation will be retained based on the LCSM and the results of the groundwater fate and transport modeling.

3.5 Treatability Studies

TCE and other related volatile organic compounds have been detected in sump water (groundwater seepage) into the basement of the Administration Building ranging up to 2,100 ug/l TCE (in Sump 1) and in indoor air at the Administration Building ranging up to 17 ug/m^3 TCE (sample Basement-2). Pre-emptive measures were implemented and maintained; and have been effective in addressing indoor air conditions (refer to Section 1.8).

The enhanced reductive dechlorination (ERD) program was initiated to reduce the source of cVOCs in groundwater adjacent and beneath the Administration Building to effectively treat the presumed source of the VOC's. Significant reductions in VOC's in groundwater have been monitored since starting the ERD program in August 2018.

The January 2018 Interim Remedial Measures Work Plan – Enhanced Reductive Dechlorination Work Plan (ERD Work Plan) described the results of bench-scale pilot testing and provided the procedures for a field-scale pilot test. In an April 9, 2018 letter to DNREC, the ERD Work Plan was proposed to be implemented as a field-scale pilot test. DNREC approved the IRM Work Plan as a field-scale pilot test in a letter dated April 23, 2018. The ERD Work Plan and correspondence referred to above are included in **Appendix 3-3**.

Reductive dechlorination is a natural process in which native bacteria in soils and groundwater degrade dissolved-phase, chlorinated solvents in the environment. In this process, the chlorinated solvent serves as an electron acceptor (or weak oxidizing agent) that is reduced by reactions with other chemicals in the groundwater that serve as electron donors. Typical electron donors include natural organic carbon, dissolved hydrocarbon gases and dissolved hydrogen.

As described below, ERD bench-scale pilot testing demonstrated that the addition of an electron (carbon) donor solution (2% sodium lactate solution) is effective in promoting the sequential dechlorination of TCE through anaerobic microbial processes.

3.5.1 Bench-Scale Treatability Testing

Bench-scale ERD treatability testing was conducted to evaluate the feasibility of the ERD technology for remediation of chlorinated solvents under site-specific geochemical conditions. The testing protocol for the treatability study was designed to achieve the necessary objectives required to provide a bench-scale evaluation of the ERD technology and design parameters for a potential field application at the Site. In particular, an effective treatability test for reductive biological treatment must evaluate the following:

- Need for native microbes to be supplemented;
- Identify specific carbon substrate for injection and biodegradation rate enhancement;
- Longevity of injected electron donor source;
- ERD reaction kinetics for destruction of chlorinated solvents; and
- Potential magnitude of native metals (manganese, iron and arsenic) mobilization.

Representative samples of site soil were collected by Stantec personnel on July 15, 2015. A 5-foot, Geoprobe sample core was collected from the saturated zone during the installation of monitoring well NY-MW-26, within the plume area. The sample core was cut into manageable lengths, and the ends capped and sealed for transport. A 5-

gallon sample of groundwater was collected from monitoring well NY-MW-2 to be used during bench-scale testing. The soil and groundwater sample containers were labeled, placed on ice, and shipped by over-night courier to Stantec's Treatability Testing Services Group in Sylvania, Ohio for bench-scale testing. In addition, groundwater samples were sent to Eurofins Lancaster Laboratories Environmental (Lancaster) for VOC analysis using USEPA method 8260B, and SiREM Laboratories, Inc. (SiREM) for qualitative and quantitative screening of the dehalococcoides bacteria responsible for the reduction of cis-1,2-DCE, since the overall biological process can become rate inhibited (cis-1,2-DCE stall) in their absence.

Five test groups were prepared to determine the natural degradation rates for the chlorinated contaminants, evaluate the enhancement of electron donor addition, and identify potential process limitations.

- The first sample group was an active control and served as a baseline for a system with no additives.
- The second sample set served as a sterile control group, with the samples spiked with sulfuric acid to halt biological activity.
- The third and fourth sample groups were supplemented with sodium lactate and sodium acetate, respectively, to serve as electron donors.
- The fifth and final group used a supplemental solution of emulsified vegetable oil (EVO).

A detailed discussion of the bench-scale pilot test procedures is presented in Appendix 4-1 of the ERD Work Plan. Conclusions from the bench-scale pilot test included:

- The addition of a supplemental, carbon-based electron donor to the subsurface of the Site can successfully produce the necessary anaerobic and reducing conditions within the saturated soil system for rapid reductive dechlorination kinetics to occur using native bacteria in the soil and groundwater,
- The testing verified sufficient indigenous microbial populations exist for field implementation of an ERD program, and
- The best chlorinated VOC reduction and process performance was observed using sodium lactate as a supplemental carbon substrate. Sodium lactate is a commercially available, food-grade product commonly used during ERD applications due to its low-viscosity and miscibility in water, allowing for ease of distribution during subsurface injections. Reductive dechlorination typically will

not occur at ORP values greater than +50 mV, and reactions kinetics are usually optimized at values less than -100 mV. Values in this range are indicative of sulfate reducing and/or methanogenic conditions.

As indicated, the ERD bench-scale pilot testing demonstrated that the addition of an electron (carbon) donor solution (2% sodium lactate solution) can be effective in promoting the sequential dechlorination of TCE through anaerobic microbial processes. A summary of the bench-scale pilot test was provided in the ERD Work Plan.

3.5.2 Field-Scale Treatability Testing

Considering the results of the bench-scale pilot test, a field scale pilot test was conducted in accordance with the ERD Work Plan. The field-scale pilot test was implemented under DNREC Rule Authorization #UIC 5X26-05-18N effective May 7, 2018 through June 1, 2020 (refer to **Appendix 3-4**).

The ERD Work Plan was prepared to address chlorinated VOCs (primarily TCE) in groundwater in areas of the Maintenance Facility located to the east of the Administration Building. The ERD injection area is depicted on **Figure 3-1**. The Maintenance Facility (DE-0170) monitoring well locations in the vicinity of the ERD treatment area and ERD injection well locations are displayed on **Figure 3-2**.

The ERD pilot test procedures and results are included in the ERD Technical Memorandum included in **Appendix 3-5**. Interim UIC Reports dated September 14, 2018 and June 4, 2019 were submitted to DNREC to document the August 2018 and May 2019 sodium lactate addition events (refer to **Appendix 3-4**).

The implementation of the field-scale ERD pilot test is summarized below:

- Collection of baseline data.
    - Groundwater – Field parameter measurements (pH, DO, ORP, specific conductance) were recorded and groundwater samples were collected for laboratory analyses from performance monitoring wells.
    - Indoor Air – Two indoor air samples (summa canisters) were collected from the Administration Building basement (at previously established sample locations Basement-1 and Basement-2) on August 8, 2018. TCE was reported at a concentration of 22 ug/m^3 in sample Basement-1. Cis-1,2-DCE was also detected at this location at a concentration of 18 ug/m^3.

- Administration Building Basement Dewatering System – Water samples were collected from the Administration Building basement water treatment system. All sumps except the sump located at the base of the ramp at the south end of the building (Sump 6) are routed through the GAC treatment system. Flow is routed through two sets of GAC units (A and B). Influent samples (A-1 and B-1) have historically been collected for VOC analyses (since October 2011). TCE concentrations in samples collected prior to the initiation of ERD injections ranged from 81 to 410 ug/l (Influent A-1) and from 75 to 420 ug/l (Influent B-1). The variability in these sample results may be attributed to the cycling of pumps from different sumps at the time of sampling as well as the number of sumps (different sumps have different VOC concentrations) routed to the treatment system at the time of sampling.

- Implementation of sodium lactate injections.
  - A total of 35 electron donor solution injection wells (ERD-1 through ERD-35) were installed by a Delaware licensed driller.
  - The first round of sodium lactate injections was performed August 15-27, 2018. A total of approximately 25,400 gallons of 2% sodium lactate solution was injected into 20 of the 35 ERD wells targeting the "core" of the VOC plume.
  - The second round of sodium lactate injections was performed May 13-18, 2019, May 20-24, 2019, and May 28, 2019. A total of approximately 51,491 gallons of 2.43% sodium lactate solution was injected into ERD-1 through ERD-35 and SVE-6 through SVE-12.
  - During the injections solution addition rates, total volume of fluid injected, and injection pressures were monitored for each injection well.
  - In addition, groundwater field parameter measurements were monitored at nearby wells during injection activities. The increase in water levels and specific conductance measurements in nearby monitoring wells confirmed that the solution was effectively distributed in the subsurface. As anticipated, the ORP in groundwater was significantly reduced as the activity of the native bacteria was enhanced through the addition of the sodium lactate solution.

- Collection of post-injection data.
  - Groundwater field parameter measurements (pH, DO, ORP, specific conductance) were recorded and groundwater samples were collected for laboratory analyses from performance monitoring wells during the following dates:
    - October 2018: Groundwater samples were collected from performance monitoring wells distributed within and adjacent to the treatment area. When compared to baseline groundwater samples, a significant decrease in TCE and a significant increase in TCE breakdown products 1,2-DCE and vinyl chloride were observed. Samples from NY-MW-2 and NY-MW-26 were also sent to Sirem Labs for the analyses of Dehalococcoides (Dhc) (reductive dechlorination promoting bacteria). The lab report indicated the Dhc population results for both samples were indicative of "high concentrations of Dhc, often associated with significant dechlorination rates".
    - January/February 2019: Groundwater samples were collected from performance monitoring wells distributed within and adjacent to the treatment area. When compared to baseline and October 2018 groundwater samples, cVOCs in groundwater in the source area continued to decrease. Samples from NY-MW-2 and NY-MW-26 (located within the core "treatment area" of the VOC plume) indicated TCE concentrations continued to decline. Concentrations of 1,2-DCE and vinyl chloride were higher than baseline conditions but declined between the October 2018 and January/February 2019 sampling events, which is attributed to lower TCE concentrations available for further anaerobic reduction.
    - June 2019: Groundwater samples were collected from performance monitoring wells distributed within and adjacent to the treatment area. When compared to baseline through January/February 2019 groundwater samples, VOCs in groundwater in the source area continued to decrease. VOCs in groundwater downgradient of the source area also indicated a significate decrease. Samples from NY-MW-2 and NY-MW-26 (located within the core "treatment area" of the VOC plume) indicated TCE concentrations continued to decline, while concentrations of cis-1,2-DCE and vinyl chloride increased in NY-MW-2; concentrations of cis-1,2-DCE and vinyl chloride decreased significantly in NY-MW-26 during the June 2019 sampling event. The increase is attributed to further anaerobic reduction of TCE into its breakdown products. Samples from MW-NY-30

and MW-NY-31 (located downgradient of the core "treatment area") also indicated decreasing concentrations. TCE concentrations in these wells decreased to non-detect concentrations during the June 2019 event. Concentrations of cis-1,2-DCE and vinyl chloride also indicated a significant decrease in these wells following the initial increase observed after the initial round of injections.

- Indoor Air – Multiple rounds of indoor air samples were collected from the Administration Building to document conditions after the sodium lactate injections on the following dates:

    - October 2018: Two indoor air samples (summa canisters) were collected from the Administration Building basement (at previously established sample locations Basement-1 and Basement-2). An additional sample, Basement-3, was collected at the request of Amtrak. TCE was reported at a concentration of 5.4 ug/m^3 in sample Basement-1. Cis-1,2-DCE was detected at Basement-1at a concentration of 8.7 ug/m^3 and at Basement-3 at a concentration of 4.9 ug/m^3.

    - December 2018: A more comprehensive indoor air sampling event, consisting of ten indoor air samples (summa canisters), was performed for the Administration Building including two locations in the basement (at previously established sample locations Basement-1 and Basement-2), four locations on the 1st floor, and four locations on the 2nd floor. TCE was not detected in any of the samples. Cis-1,2-DCE (6.1 ug/m^3) and vinyl chloride (4.3 ug/m^3) were detected at low concentrations in sample Basement-1.

    - March 2019: Two indoor air samples (summa canisters) were collected from the Administration Building basement (at previously established sample locations Basement-1 and Basement-2). Neither TCE nor TCE degradation products were detected in either sample.

    - July 2019: Two indoor air samples (summa canisters) were collected from the Administration Building basement (at previously established sample locations Basement-1 and Basement-2). TCE was reported at a concentration of 6.0 ug/m^3 in sample Basement-1. Cis-1,2-DCE was reported at a concentration of 4.7 ug/m^3 in sample Basement-1. It should be noted that the reporting limits for TCE and cis-1,2-DCE were 5.4 ug/m^3 and 4.0 ug/m^3, respectively. Indoor air monitoring in the Administration Building is ongoing.

- Basement Dewatering System – Periodic sampling of the basement system has continued following the sodium lactate injections. Sampling results indicate a substantial decrease in TCE concentrations, and an initial increase followed by a consistent decrease in TCE breakdown products cis-1,2-DCE and vinyl chloride in the influent samples.

Based on the information presented above the following conclusions are made:

- Groundwater field parameter data collected and *Dhc* populations indicate that the sodium lactate injections have resulted in subsurface conditions being conducive to ERD.

- The post-injection groundwater sampling analytical results indicate a significant decrease in TCE concentrations with an initial increase followed by a consistent decrease in TCE breakdown products cis-1,2-DCE and vinyl chloride. Further reduction of TCE, cis-1,2-DCE, and vinyl chloride is anticipated. **Figure 3-3** displays cVOC groundwater concentration data for wells in the treatment area.

- cVOCs detected in indoor air in the Administration Building basement have been reduced based on monitoring conducted following the sodium lactate injections.

- Following the sodium lactate injections, the basement dewatering sampling results also indicate a substantial decrease in TCE concentrations, and an initial increase followed by a consistent decrease in TCE breakdown products cis-1,2-DCE and vinyl chloride in the influent samples. **Figure 3-4** displays VOC concentrations data for the Administration Building sump water treatments system.

- As described in the ERD Technical Memorandum included in **Appendix 3-5**, cVOCs have also been detected NY-MW-34 and NY-MW-37 located cross-gradient from the Locomotive Shop source area at significantly lower concentrations than in the presumed source area. Additionally, the ratio of PCE to TCE is higher in NY-MW-34 and NY-MW-37 than in wells located in the Locomotive Shop source area. These lines of evidence suggest that the Locomotive Shop area is not related to cVOC occurrence in these wells although soil data does not identify another source area. However, the highest TCE concentration in NY-MW-15 (located further downgradient of NY-MW-34 and NY-MW-37 and closer to the NED) is 7 ug/l, below the DNREC ecological freshwater screening level of 21 ug/l (updated November 2019). The proposed monitored natural attenuation remedy will also include this area.

Stantec will continue to implement the performance monitoring program in accordance with the LTS. The results will be used to assess the effectiveness of the electron donor solution in reducing cVOCs concentration and attaining/maintaining suitable geochemical conditions for ERD. The performance monitoring program (to be described in the LTS) will also assess whether subsequent electron donor solution addition events or additional electron donor solution wells are necessary.

4.0 DEFINITION OF REMEDIAL ALTERNATIVES

The remedial technologies and process options retained from the evaluation of treatment technologies (refer to Section 3.0), were developed into remedial alternatives. The remedial alternatives presented below consider the results of the detailed screening of technologies and alternatives presented in the June 2017 Revised Supplemental Focused Feasibility Study Report (RSFFS) for the Former Fueling Facility (DE-0266) as well as remedial goals for the Former Fueling Facility. DNREC's July 11, 2019 e-mail to Stantec indicated it is acceptable to use the remedial goals for the Former Fueling Facility (as described in the June 2017 RSFFS, September 2018 RSFFS Addendum 1, and October 2019 RSFFS Addendum 2) for the Maintenance Facility. Based on the results of environmental sampling and the layout of the Site, the remedial alternatives for the Maintenance Facility consider the following media and areas:

- Upland soil including soils (outside areas) in the Outfall 002 drainage area of the Maintenance Facility,
- Outfall 002 Drainage Ditch Sediments, and
- LNAPL/Groundwater in the Maintenance Facility (including the Outfall 002 and Outfall 007 drainage area).

As will be described below, there are certain activities/remedial components that will be implemented with any combination of the alternatives for soil and sediments. These are referred to as Common Elements.

The remedial alternatives provided below build upon the screening of remedial alternatives conducted for the Former Fueling Facility and Agency comments (as referenced above). As such, focused remedial alternatives for the Maintenance Facility are presented below based on remedial technology/alternatives screening performed for the Former Fueling Facility, Agency interactions, results of environmental sampling, site conditions, and field-scale pilot testing.

4.1 Definition of Alternatives

This discussion is presented based on the groupings of media and areas described above. **Table 4-1** presents a description of the Remedial Alternatives described below.

The descriptions of the remedial alternatives provided below are presented for descriptive purposes. It is envisioned that after Agency approval of the remedial alternatives to be implemented, there will be a design phase during which detailed design specification documents for construction will be prepared and contractor/vendor implementation will be solicited. As such, the descriptions and schematic representations of the remedial alternatives provided below are not intended for construction without a detailed design phase.

It should be noted that the Amtrak Wilmington Shops is a large operational industrial facility with extensive infrastructure including underground utilities (such as storm, sanitary and industrial waste sewers; potable water, gas, electric, fiber optic conduits; and track switch controls), overhead energized catenary systems, other overhead utilities and an expansive network of railroad track servicing multiple maintenance shops. As will be described, Facility operational and safety concerns are considered in the development and selection of remedial alternatives.

4.2 Upland Soils – Alternative WMF S-1

Consistent with the Upland Soil remedy for the Former Fueling Facility, Alternative WMF S-1 targets soil removal to achieve an upper bound, cumulative cancer risk of less than 1E-04 and a non-cancer hazard index of less than 1.0 (by target organ system) after this targeted soil removal and before any additional remedial action. Alternative WMF S-1 is displayed on **Figure 4-1**. The details of Alternative WMF-S-1 including metrics and cost estimate are provided in **Appendix 4-1**. Components of Alternative WMF S-1, include:

- Target soil removal to Remedial Goals based on cumulative cancer risk 1E-04 and a non-cancer hazard index of less than 1.0 for the main risk-driving constituents total PCBs (tPCBs). Soil removal areas are defined locations with tPCBs>100 mg/kg. Excavated soils with PCB concentrations greater than or equal to 50 mg/kg would be disposed of at a TSCA-licensed land disposal facility. **Figure 4-2** presents the planned excavation areas. The extent of the excavation areas has been estimated for the purpose of depicting this component of the Upland Soils remedy. Characterization sampling that has been conducted has identified certain "hot spots".   A localized pre-excavation sampling scheme focused on the identified "hot spots" will be described in the Remedial Design to further delineate for field specification of the extent of excavation areas prior to construction.

- A TSCA-equivalent cap will be placed over soils with tPCB concentrations ranging from greater than or equal to 50 mg/kg to 100 mg/kg. **Figure 4-3** presents the cap areas for the Upland Sol remedial alternative.   The extent of the cap areas has been estimated for the purpose of depicting this component of the Upland Soils remedy. As mentioned above, a localized pre-excavation sampling scheme will be described in the Remedial Design to further delineate for field specification of the extent of cap areas prior to construction. Locations reporting PCB concentrations >100 m/kg PCBs will be excavated. If post-excavation sample results report PCB concentrations ≥50 mg/kg PCBs and ≤100 mg/kg a TSCA equivalent cap will be placed. If post-excavation sample results report PCBs <50 mg/kg, an engineered cover will be placed. Therefore, TSCA equivalent caps are depicted on **Figures 4-1** and **4-3** to coincide with PCB excavation areas in the event that post-excavation results report PCB concentrations ≥50 mg/kg PCBs and ≦100 mg/kg. If post-excavation samples report <50 mg/kg tPCBs, a TSCA-equivalent cap will not be needed, and an engineered cover will be placed. TSCA-equivalent caps include a geosynthetic clay liner (GCL) and earthen fill, or a minimum 6 inches of asphalt or concrete, meeting the TSCA-equivalent cap requirements (40 CFR 761.61(a)(7)) (TSCA-equivalent cap; refer to **Figure 4-4**). The type of TSCA-equivalent cap will be selected based on facility operations.

- An engineered cover would be placed over all other areas (including areas with PCB concentrations greater than 1 mg/kg). All areas will be covered to significantly reduce PCB loading to the Delaware Estuary, minimize dermal contact with soils and minimize airborne suspension of exposed soil. These covers will also minimize rainwater runoff contact with exposed soils and will serve as pollutant minimization measure consistent with the PMP activities for PCBs ongoing at the Facility. PMP minimization measures and other recent Facility maintenance activities will also serve as engineered covers. **Figure 4-5** displays existing measures that serve as engineered covers. The application of engineered covers will be consistent with Facility operations in specific locations. **Figure 4-6** presents recommended engineered covers. Existing and recommended engineered covers may include one or more of the following:

    - Geotextile overlain by a minimum 6 inches of soil, seeding of soil,
    - Geotextile overlain by stone ballast (adjacent to track areas),
    - Surface water management controls including bioretention areas (grassed),
    - Roadways,
    - Asphalt or concrete (new) cover, and
    - Upgrade of existing asphalt, concrete or building cover.

    This alternative includes the maintenance/up keep of all (existing and planned) engineered covers which will be included in the Long Term Stewardship Plan for the Facility.

As has been described, elevated concentrations cVOCs primarily TCE and associated degradation products, have been detected in site soils in an area between the Administration Building and west of and partially beneath of the Locomotive Shop. This area is underlain by facility utilities and building foundations and soil removal in this area is not practical. As described in Section 3.5, the ERD field-scale pilot test has been implemented in this area to address cVOCs in soil and groundwater in this area. The pilot test has indicated that ERD is an effective technology for addressing cVOCs in the subsurface. The depth to groundwater in this area is shallow (generally less than 4 feet bgs) and water level fluctuation was measured during the addition of the electron donor solutions. Since performance monitoring of the ERD program is a component of the LNAPL/groundwater remedial alternative, cVOCs in soils, this area will be addressed under the ERD program. Also, this area is under asphalt or concrete and the cover will remain and maintained in accordance with the LTS for the Facility.

4.3 Outfall 002 Drainage Ditch Sediments – Alternative WMF Sed-1

The Outfall 002 drainage feature extends from the Outfall 002 outlet structure to Shellpot Creek. Considering the relatively small volume of sediments in the drainage feature (approximately 75 cubic yards) and there is less than 0.5 feet of sediments above a concrete substrate, Alternative WMF Sed-1 consists of the removal of these sediments and transportation to the Eastern Drainage Ditch so these sediments can be included as part of the in-situ stabilization of sediments proposed for the Former Fueling Facility. Sediment remedial alternative WMF Sed-1 is depicted on **Figure 4-7**. The tPCB concentrations in the two sediment samples collected from this drainage feature were 3.9 mg/kg and 17.3 mg/kg. The sediments will be removed (likely by a vac truck) to the top of the concrete base. Under the upland soil remedy (refer to **Figure 4-6**), engineered covers will be placed on the banks of the Outfall 002 drainage ditch. The details of Alternative WMF-Sed-1 including metrics and cost estimate are provided in **Appendix 4-1**.

4.4 LNAPL/Groundwater – Alternative WMF LN-1

LNAPL/Groundwater Alternative WMF LN-1 includes monitored natural attenuation until project close-out in accordance with the LTS for the Facility. The details of Alternative WMF-LN-1 including metrics and cost estimate are provided in **Appendix 4-1**.

LNAPL migration and recoverability evaluations indicate that the LNAPL is not migrating and is not considered recoverable. Groundwater fate and transport modeling indicates that the dissolved phase concentrations of cVOCs are degrading and therefore are not expected to migrate further downgradient. The ERD program has demonstrated that the technology has been effective in further reducing cVOC concentrations. The Site is also within the City of Wilmington Groundwater Management Zone, an institutional control that regulates use of groundwater and prevents exposure to groundwater.

As described in Section 1.8, IRMs have been implemented to address potential indoor air concerns associated with groundwater. As a precaution, any new construction of permanent occupied buildings would include a vapor barrier.

The ERD field-scale pilot testing has demonstrated that ERD is an effective technology for the reduction of cVOCs at the Site. The ERD pilot test area and site-wide groundwater will continue to be monitored.

Considering that: 1) there is no potable use of groundwater in the vicinity of the Site and the Site is within the City of Wilmington GMZ; 2) IRMs have been implemented and maintained to address indoor air concerns associated with groundwater; 3) groundwater fate and transport modeling indicates that the dissolved phase concentrations of cVOCs are degrading and therefore are not expected to migrate further downgradient; and 4) the ERD has proven to be effective in addressing cVOCs in the subsurface, the final remedial action would consist of continued operation of the IRMs, continued monitoring of the ERD program and monitored natural attenuation.

4.5 Common Elements – Alternative WMF-CE-1

Alternative CE-1 describes elements common to all remedial Alternatives previously discussed. The details of Alternative WMF-CE-1 including metrics and cost estimate are provided in **Appendix 4-1**. Common Elements previously recommended for the Former Fueling Facility that also pertain to Maintenance Facility include:

- Track maintenance events will occur in certain areas of the Facility as part of the Upland Soil remedy as described in the Common Elements for the Former Fueling Facility (refer to RSFFS Report). For example, in the Maintenance Facility, a track maintenance event will be performed on "0" track which runs along the northwestern perimeter of the study area, adjacent to the mainline tracks (refer to **Figure 4-6**). The maintenance event will consist of removing existing railroad cinders/ballast (by vacuum or other methods) to at least the bottom of the rail ties and off-site TSCA disposal of the removed cinders/ballast. A new wear surface consisting of ballast will be placed. The rail ties are approximately eight-inches thick, therefore the wear surface will be approximately eight-inches thick. This wear surface would prevent dermal contact with exposed soils and would also function as a pollutant minimization measure to reduce the potential for off-site migration consistent with the PMP for PCBs ongoing at the Facility. All other track areas in the Maintenance Facility were: 1) recently replaced (including the Wreck Track located immediately east of the "0" track and the Roadway Department track area located in the northern portion of the Facility); 2) are paved (the transfer track which runs between the Administration Building in the Locomotive Shop); or 3) will be replaced as part of the implementation of engineered covers (track sections adjacent to the transfer table; refer to **Figure 4-6**).

- Repair Outfall 002 storm water conveyance (the storm water conveyance has been recently cleaned under the PMP program for the Facility),
- Integrate caps and/or engineered covers into any pre-existing structure that remains through the remediation process,
- Consider flood plain regulations concerning increases in storm water flow,
- Develop and Implement a Long-Term Stewardship Plan (LTS),
- Implement Environmental Covenants consistent with UECA and TSCA,
- Brandywine River and Shellpot Creek floodgates must be fixed by the appropriate government agency. Stantec will work with Amtrak and the appropriate agencies including the City of Wilmington to coordinate that the floodgates are repaired, in good working condition and maintained prior to and throughout the planned remediation project at the Facility as well as into the future.
- The effects of climate change at the Site are being assessed as part of Amtrak's Northeast Corridor program,
- Allowance for permitting related to remedy implementation,
- Allowance for miscellaneous disposal of debris and materials generated during remedy implementation,
- Continue to operate and maintain the Administration Building (Building #12) indoor air IRMs in accordance with the LTS until project close-out, and
- The LTS will include discussion of operations, maintenance/monitoring and endpoints for the ERD and indoor air IRM programs (as well as potential additional remedial alternatives in the event that endpoints cannot be met through existing measures). The LTS will also include Environmental Covenants consistent with the Uniform Environmental Covenants Act (UECA) and TSCA.

5.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial Alternatives were developed to address upland soils in the Outfall 002 drainage area, sediments in the Outfall 002 drainage ditch feature, and LNAPL/groundwater in the Maintenance Facility. This section provides a detailed analysis of the alternatives described in Section 4.0.

The objective of the detailed analysis of Remedial Alternatives is to evaluate each alternative against a set of criteria that DNREC uses to make the selection of the preferred alternative. The detailed screening of the Remedial Alternatives is presented in a tabular format. Each alternative is discussed briefly in relation to the criteria so that the alternatives can be compared to each other against each of the criteria. The relative advantages and disadvantages of the various remedial alternatives, therefore, can be indicated. A summary and discussion of the recommended Remedial Alternatives are presented in Section 6.0. The criteria by which the alternatives are evaluated are identified and discussed below.

5.1 Evaluation Criteria

<u>Overall Protection of Human Health and the Environment</u>
This criterion gauges how well the alternative protects human health and the environment by the minimization or elimination of direct exposure pathways.

<u>Compliance with ARARs</u>
The ARARs are binding legal regulations and regulatory suggestions that must be met on the Site unless they are waived. Chemical specific, location specific, and action specific laws and regulations were reviewed and identified for the Site and the remedial alternatives. Compliance with ARARs is a criterion for selection of the remedial alternative to be enacted unless they are waived.

<u>Long-Term Effectiveness and Permanence</u>
This criterion determines the effectiveness of the remedial alternative once cleanup has been completed. It shows how permanent a solution will be—how long the elimination or reduction of the exposure pathways will last. It also helps identify the expected lifespan of certain remediation technologies and engineering controls. Permanence is also discussed further in this Section.

<u>Reduction of Toxicity, Mobility, or Volume through Treatment</u>
This criterion demonstrates the degree to which toxicity, mobility, and volume of contaminants are reduced through the implementation of an alternative. It determines how on-site risks have been affected by the changes in toxicity, mobility, or volume of the contaminant. It also determines how contaminant concentrations are expected to

change and how much mass or volume of material will be contained, removed, or destroyed as part of the remediation.

Short-term Effectiveness

Short-term effectiveness is the measurement of the elimination or reduction of the exposure pathways during remediation. It shows the immediate effects of the remedial alternative. The short-term effectiveness includes exposure pathways that may arise during remediation, including inhalation during transport and direct contact for remedial workers. It directly gauges how much a remediation effort may affect the health of humans and the environment while remedial activities are ongoing. A site health and safety plan addresses any short-term effectiveness issues that may be involved with the chosen remedial alternative.

Implementability

The implementability shows how feasible it is to employ a certain remedial alternative plan at the Site, considering railroad operations and other components, and evaluates the likelihood that the technology would meet performance specifications. Implementability involves issues concerning construction and operation, potential human and environmental health consequences, and materials handling.

Cost

Cost considerations include capital costs, operation costs, and maintenance costs.

State and Community Acceptance

This criterion demonstrates the ease of administrative regulatory approval and addresses possible community issues. While Delaware HSCA guidance only includes community acceptance, the USEPA includes state acceptance as well; as such, in this document, state and community acceptance will be evaluated.

Remediation Monitoring

Remediation monitoring includes plans for compliance monitoring, during and after remediation activities, demonstrating the success of the remediation. Potential scenarios in which the remediation is unsuccessful must be addressed.

Permanence

Permanence refers to how much of the contaminant was removed, destroyed, and/or treated by the remediation activities and the degree to which the treatment is reversible. In addition, this criterion determines the contaminants remaining after the alternative is implemented and the associated risk.

Restoration Time Frame

Restoration time frame refers to the expected time until the remediation activities mitigate threats associated with the contaminants, and time until remedial action objectives have been achieved.

5.2 Individual Evaluation of Alternatives

For the purposes of this RI/FFS Report, the detailed evaluation is presented in a tabular format. The detailed evaluation of all alternatives is presented on **Table 5-1**.

6.0 SUMMARY AND RECOMMENDED REMEDY

This RI/FFS Report presents remedial alternatives which target soil in the Outfall 002 drainage area of the Maintenance Facility, sediments in the Outfall 002 drainage feature and LNAPL/groundwater in the Maintenance Facility. As has been described, the remedial goals and remedial alternatives consider Agency comments of those proposed for the Former Fueling Facility (DE-0266) portion of the Amtrak Wilmington Yard.

The Amtrak Wilmington Shops play a critical role in passenger rail service on the Northeast Corridor. The Wilmington Shops is Amtrak's only Facility for over-hauling electric locomotives. When the assets of the bankrupt Penn Central Railroad were transferred in 1976, the Federal Railroad Administration required Amtrak to execute a 999-year mortgage on all properties, including the Wilmington Shops. Amtrak will control the Site into the future and has plans to continuously occupy the property for railroad operations for the foreseeable future and there should be no concern that this situation will change.

The alternatives presented in this RI/FFS Report have been developed based on extensive investigations. Several phases of remedial investigations and treatability studies have been performed which are summarized in this Report. Human health risk assessments and ecological investigations have also been conducted. The Post-Remediation human health risk assessment scenario indicates the Remedial Goals of eliminating exposure to site soils to a cancer risk of 1E-04 and to a non-cancer hazard index of less than 1.0 by target organ/system for the standard Outdoor Worker has been met through the implementation of the recommended alternatives (refer to Section 1.11).

This RI/FFS Report also considers Agency comments to the RSFFS for the Former Fueling Facility (DE-0266) of the Amtrak Wilmington Maintenance Shops. Included in this RI/FFS Report are:

- A human health risk assessment which demonstrates that after implementation of the recommended Upland Soil remedial alternative (WMF-S-1), the target cleanup goal of a cumulative cancer risk less than 1E-04 and non-cancer risk hazard index of less than 1.0 for a hypothetical Standard Outdoor Worker will be met prior to the implementation of other remedial measures including capping and engineered covers of the remaining soil at the Site.

- The results of extensive additional soil sampling completed since the Interim Data Submittal – Remedial Investigation (IDS; March 2015). A summary of extensive previous investigations is also included.

- The results of bench-scale and field-scale pilot testing of enhanced reductive dechlorination (ERD) of chlorinated volatile organic compounds (cVOCs) in the subsurface in a portion of the Maintenance Facility, in-situ stabilization of the sediments in the Eastern Drainage Ditch,

- The results of the LNAPL/groundwater natural attenuation modeling, and

- Focused remedial alternatives that are consistent with the remedial goals and remedial alternatives for the Former Fueling Facility (DE-0266). Those remedial alternatives considered both self-implementing PCB remediation (761.61(a)) remedial goals [which are not considered applicable to this Site since the Site is not a "general, moderately sized site"] and risk-based (761.61(c)) remedial goals, which allow for more practical remedial actions.

The alternatives presented in this RI/FFS Report have been developed based on extensive investigations of upland soils, sediments in the drainage ditches, surface water and groundwater. Several phases of remedial investigations and treatability studies have been performed which are summarized in this RI/FFS Report.

Environmental covenants would be implemented to ensure that future property use is consistent with the assumptions of the human health risk assessment. A Long-Term Stewardship Plan (LTS) will be implemented that will specify inspection and maintenance for the controls implemented to address future soil handling and other facility-specific requirements.

As has been described, 40 CFR Part 761 permits the use of various self-implementing alternatives and/or risk-based PCB remediation alternatives. 40 CFR 761 specifically acknowledges that the self-implementing approach was designed for a general moderately sized Site where there should be low residual impact from remedial activities. Because of the Site's large size and complexity, the self-implementing approach is not applicable, and the risk-based approach is most appropriate for the Maintenance Facility. This risk-based approach is consistent with 40 CFR Part 761, the nine (9) evaluation criteria set forth in the National Contingency Plan (NCP) under CERCLA at 40 C.F.R. §300.430(e)(9)(iii)(A) thru (I), the Delaware HSCA, DNREC's HSCA Regulation and Guidance Manual and the pollutant minimization program (PMP) established by the Delaware River Basin Commission (DRBC) to implement the Total Maximum Daily Load (TMDL) for PCBs in the Delaware River Estuary. The PCB remediation criteria associated with self-implementing options permitted by 40 CFR Part 761 were included in the development of remedial alternatives for comparison purposes, and this comparison demonstrated how impractical those options would be. Remedial action goals were developed considering the contaminants of concern as well as the exposure routes and receptors. The goals consider the current and future uses of the Site, the use and level of contamination of surrounding properties, Facility specific risk assessments, and applicable laws and regulations.

6.1 Recommended Alternatives and Justification

The following is a summary of the recommended alternatives based on the detailed screening and comparative analyses provided in previous sections of this Report.

The preceding sections of this RSFFS Report demonstrate that the recommended remedial alternatives would be consistent with: (1) Delaware's HSCA and DNREC's HSCA Regulations and Guidance Manual; (2) applicable requirements of federal law established under (a) the TSCA, 40 C.F.R. Section 761.61(c), (b) CERCLA and the NCP; and (c) CWA PCB TMDL and (3) future use of the Facility for railroad operations or other non-residential uses. The recommended alternatives would be protective of human health and the environment since:

- The recommended alternative for soils would provide additional human health protection and the human health risk assessment is consistent with the remedial goals for the Site.
- The recommended alternatives would minimize surface water contact with PCBs in upland soil and sediment, significantly reducing PCB loading from the Site,
- Bench-scale and field-scale treatability tests (documented in this report) have been performed to verify the performance of ERD, and
- The recommended alternatives include environmental covenants to require that the long-term property use will be consistent with the assumptions of the risk assessment.

There are components (referred to as Common Elements) that will be implemented for any combination of the alternatives. These include:

- Track maintenance events will occur in certain areas of the Facility as described in the Common Elements for the Former Fueling Facility (refer to RSFFS Report). For example, in the Maintenance Facility, a track maintenance event will be performed on "0" track which runs along the northwestern perimeter of the study area, adjacent to the mainline tracks (refer to **Figure 4-6**). The maintenance event will consist of removing existing railroad cinders/ballast (by vacuum or other methods) to at least the bottom of the rail ties and off-site TSCA disposal of the removed cinders/ballast. A new wear surface consisting of ballast will be placed. The rail ties are approximately eight-inches thick, therefore the wear surface will be approximately eight-inches thick. This wear surface would prevent dermal contact with exposed soils and would also function as a pollutant minimization measure to reduce the potential for off-site migration consistent with the PMP for PCBs ongoing at the Facility. Other track areas in the Maintenance Facility were: 1) recently replaced (including the Wreck Track located immediately east of the "0" track and the Roadway Department track area located in the northern portion of the Facility); 2) are paved (the transfer track which runs between the Administration Building in the Locomotive Shop); or 3) will be replaced as part of the implementation of engineered covers (track sections adjacent to the transfer table; refer to **Figure 4-6**).

- A Long-Term Stewardship Plan (LTS) will be developed and implemented. The LTS will assure that the selected Remedial Alternatives are properly maintained and monitored including maintenance of the caps, engineered covers and groundwater monitoring program. The LTS will include discussion of operations, maintenance/monitoring and endpoints for the ERD and indoor air IRM programs (as well as potential additional remedial alternatives in the event that endpoints cannot be met through existing measures). Also, the LTS will detail the inspection and monitoring schedule to ensure the long-term integrity of the remedy.

- An Environmental Covenant, consistent with Delaware's Uniform Covenants Act (Title 7, Del. Code 79, Subtitle II) (UECA), will be filed (recorded) in the office of the Recorder of Deeds that will:

    - Restrict land use to non-residential uses,
    - Require a Post-Remediation Care Plan (may be a component of the LTS described above) assure that future Facility activities do not interfere with the protectiveness of the remedy,
    - Prohibit the installation of groundwater wells for drinking purposes without prior written approval from DNREC,
    - Identify the Site as located within a Groundwater Management Zone (GMZ), and
    - Comply with the Long-term Stewardship Plan.

6.1.1 Recommended Alternative for Maintenance Facility Soil

Consistent with the Upland Soil remedy for the Former Fueling Facility, Alternative WMF S-1 targets soil removal to achieve an upper bound, cumulative cancer risk of less than 1E-04 and a non-cancer hazard index of less than 1.0 (by target organ system) after this targeted soil removal and before any additional remedial action. Alternative WMF S-1 is depicted on **Figure 4-1**. Components of Alternative WMF S-1, include:

- Target soil removal to Remedial Goals based on a cumulative cancer risk of 1E-04 and non-cancer hazard index of less than 1.0 for the main risk-driving constituent total PCBs (tPCBs). Soil removal areas are defined locations with tPCBs>100 mg/kg. These soils will be disposed of at a TSCA-licensed land disposal facility. **Figure 4-2** presents the planned excavation areas. The extent of the excavation areas has been estimated for the purpose of depicting this component of the Upland Soils remedy. Characterization sampling that has been conducted has identified certain "hot spots". A localized pre-excavation sampling scheme focused on the identified "hot spots" will be described in the Remedial Design to further delineate for field specification of the extent of cap areas prior to construction.

- A TSCA-equivalent cap will be placed over soils with tPCB concentrations ranging from greater than or equal to 50 mg/kg to 100 mg/kg where practicable. **Figure 4-3** presents the cap areas for the Upland Sol remedial alternative. The extent of the cap areas has been estimated for the purpose of depicting this component of the Upland Soils remedy. As mentioned above, a localized pre-excavation sampling scheme will be described in the Remedial Design to further delineate for field specification of the extent of cap areas prior to construction. Locations reporting PCB concentrations >100 m/kg PCBs will be excavated. If post-excavation sample results report PCB concentrations ≥50 mg/kg PCBs and ≤100 mg/kg a TSCA equivalent cap will be placed. If post-excavation sample results report PCBs <50 mg/kg, an engineered cover will be placed. Therefore, TSCA equivalent caps are depicted on **Figures 4-1** and **4-3** to coincide with PCB excavation areas in the event that post-excavation results report PCB concentrations ≥50 mg/kg PCBs and ≤100 mg/kg. If post-excavation samples report <50 mg/kg tPCBs, a TSCA-equivalent cap will not be needed, and an engineered cover will be placed. TSCA-equivalent caps include a geosynthetic clay liner (GCL) and earthen fill, or a minimum 6 inches of asphalt or concrete, meeting the TSCA-equivalent cap requirements (40 CFR 761.61(a)(7)) (TSCA-equivalent cap; refer to **Figure 4-4**). The type of TSCA-equivalent cap will be selected based on facility operations. Where it is impractical to place a cap due to Facility operations or maintenance issues, the area may be excavated to an extent where PCB concentrations are <50 mg/kg and an engineered cover will be placed over the backfilled excavation.

- An engineered cover would be placed over all other areas (including areas with PCB concentrations greater than 1 mg/kg). All areas will be covered to significantly reduce PCB loading to the Delaware Estuary. Engineered covers are incorporated into the Upland Soil remedial alternatives to minimize dermal contact with exposed soils as well as to minimize airborne suspension of exposed soil. These covers will also minimize rainwater runoff contact with exposed soils and will serve as pollutant minimization measure consistent with the PMP activities for PCBs ongoing at the Facility. PMP minimization measures and other recent Facility maintenance activities will also serve as engineered covers. **Figure 4-5** depicts existing measures that serve as engineered covers. The application of engineered covers will be consistent with Facility operations in specific locations. **Figure 4-6** presents recommended engineered covers. Existing and recommended engineered covers may include one or more of the following:

- Geotextile overlain by a minimum 6 inches of soil, seeding of soil,
- Geotextile overlain by stone ballast (adjacent to track areas),
- Surface water management controls including bioretention areas (grassed),
- Roadways,
- Asphalt or concrete (new) cover, and
- Upgrade of existing asphalt, concrete or building cover, with
- Maintenance/up keep of all engineered covers (to be included in the Long Term Stewardship Plan for the Facility).

As has been described, elevated concentrations cVOCs primarily TCE and associated degradation products, have been detected in Site soils in an area between the Administration Building and west of and partially beneath of the Locomotive Shop. This area is underlain by Facility utilities and building foundations and soil removal in this area is not practical. As described in Section 3.5, the ERD field-scale pilot test has been implemented in this area to address cVOCs in soil and groundwater in this area. The pilot test has indicated that ERD is an effective technology for addressing cVOCs in the subsurface. The depth to groundwater in this area is shallow (generally less than 4 feet bgs) and a significant increase in water levels was measured during the addition of the electron donor solutions. Since performance monitoring of the ERD program is a component of the LNAPL/groundwater remedial alternative, cVOCs in soils, this area will be addressed under the ERD program through project close-out (to be described in the LTS). Also, this area is under asphalt or concrete and the cover will remain and maintained in accordance with the LTS for the Facility.

Remediation to cumulative cancer risk within the range of 1E-04 to 1E-06 is consistent with the National Contingency Plan (NCP) and Role of the Baseline Risk Assessment in Superfund Remedy Selection (OSWER Directive 9355.0-30, April 22, 1991). These risk and hazard estimates were prepared using EPA's default exposure assumptions for commercial properties, which are hypothetical and do not reflect the actual work practices or potential exposures of the Amtrak workers at the Site now, in the past or in the future. In addition to the targeted soil removal, a site-wide engineered cover would be placed across the entire Site to significantly reduce the off-site migration of residual PCBs in surface soils and further limit the potential for direct contact exposure to this soil by future Site workers. Although the soil excavation component of the revised Upland Soil remedial alternative targets soil removal to achieve an upper bound, cumulative cancer risk of less than 1E-04, the level of protection with the addition of the TSCA-equivalent caps and engineered covers will be significantly more protective since all areas will be capped or covered resulting in a site-wide upper bound, cumulative cancer risk significantly less than DNREC's Voluntary Cleanup Program (VCP) target of 1E-05 and a non-cancer hazard index of less than 1.0 for all constituents. This remedy will also include institutional and engineering controls to ensure this remedy is maintained into the future.

6.1.2 Recommended Alternative for Outfall 002 Drainage Ditch Sediments

The Outfall 002 drainage feature extends from the Outfall 002 outlet structure to Shellpot Creek. Considering the relatively small volume of sediments in the drainage feature (approximately 75 cubic yards) and there is less than 0.5 feet of sediments above a concrete substrate, Alternative WMF Sed-1 consists of the removal of these sediments and inclusion for in-situ stabilization associated with the Former Fueling Facility sediments. Sediment remedial alternative WMF Sed-1 is depicted on **Figure 4-7**. The tPCB concentrations in the two sediment samples collected from this drainage feature were 3.9 mg/kg and 17.3 mg/kg. The sediments will be removed (likely by a vac truck) to the top of the concrete base. Under the upland soil remedy (refer to **Figure 4-6**), engineered covers will be placed on the banks of the Outfall 002 drainage ditch.

6.1.3 Recommended Alternative for LNAPL/Groundwater

The recommended Remedial Alternative for LNAPL/Groundwater is to implement a natural attenuation monitoring of groundwater consistent with the LTS for the Site, along with the continued operation of the IRMs and the ERD program. LNAPL/groundwater natural attenuation modeling has demonstrated that LNAPL is not mobile and the dissolved groundwater plume will continue to diminish under natural conditions. LNAPL migration and recoverability evaluations indicate that the LNAPL is not migrating and is not considered recoverable. Groundwater fate and transport modeling indicates that the dissolved phase concentrations of cVOCs are degrading and therefore are not expected to migrate further downgradient.

The ERD field-scale pilot testing has demonstrated that ERD is an effective technology for the reduction of cVOCs at the Site. The ERD pilot test area and site-wide groundwater will continue to be monitored.

As described in Section 1.8, IRMs have been implemented to address potential indoor air concerns associated with groundwater. As a precaution, any new construction of permanent occupied buildings would include a vapor barrier as a precaution.

Considering that: 1) there is no potable use of groundwater in the vicinity of the Site; 2) IRMs have been implemented and maintained to address indoor air concerns associated with groundwater; 3) groundwater fate and transport modeling indicates that the dissolved phase concentrations of cVOCs are degrading and therefore are not expected to migrate further downgradient; and 4) the ERD has proven to be effective in addressing cVOCs in the subsurface, the final remedial action would consist of continued operation of the IRMs, continued monitoring of the ERD program and monitored natural attenuation. As mentioned, groundwater fate and transport modeling indicates that the dissolved phase concentrations of cVOCs are degrading and therefore are not expected to migrate further downgradient. A recommendation would be made to DNREC in the future to discontinue measures based on Administration Building occupancy and operation and maintenance of these measures. PCBs would also be included in the groundwater monitoring program.

6.1.4 Summary

This Remedial Investigation/Focused Feasibility Study (RI/FFS Report) evaluates remedial alternatives to address contaminants in upland soils, sediments in the Outfall 002 drainage ditches and LNAPL/groundwater in the Outfall 002 and Outfall 007 drainage area (soil in the Outfall 007 drainage area was addressed under the Former Fueling Facility (DE-0266)). This RI/FFS for the Maintenance Facility (DE-0170) considers the remedial alternatives developed for the Former Fueling Facility and Agency comments to those alternatives. Based on all of the information gathered during this RI/FfS process, Amtrak, APU and Stantec recommend that the remedial action for the Maintenance Facility consist of the following components:

(1) Excavate soil in "hot spots" as defined by tPCB concentrations >100 mg/kg and dispose of all soils from that hot spot having PCB concentrations above 50 mg/kg at a TSCA-approved facility. Place a TSCA-equivalent cap or engineered cover over all of the remaining soils in the Maintenance Facility as described more fully in this Report as upland soils Alternative WMF-S-1;
(2) The removal of sediments from the Outfall 002 drainage feature to the depth of the concrete ditch substrate. These sediments will be included in the in-situ stabilization with the Former Fueling Facility sediments as described more fully in this report as Alternative WMF Sed-1;
(3) Continue to implement the ERD program in the Administration Building/Locomotive Shop area, as described in this Report, and Implement a Monitored Natural Attenuation (MNA) program to monitor the natural degradation of the contaminants remaining in groundwater under the Maintenance Facility, as described more fully in this Report as LNAPL/GW Alternative WMF-LN-1; and
(4) Implement various other remedial measures, as described more fully in this Report as Common Elements.

It is currently estimated that these remedial actions would cost approximately $4,300,000 to implement. They would be protective of human health and the environment because:

(1) Upland soils Remedial Alternative WMF-S-1 meets the goals specified by the

Agencies.

(2) Sediment Alternatives WMF-Sed-1 would remove sediments in the Outfall 002 drainage ditch to the top of the concrete substrate.

(3) Groundwater/LNAPL would meet the remedial targets established for the Former Fueling Facility through MNA; the ERD program will also be continued in accordance with the LTS.

(4) These remedies would comply with all laws and regulations, including the requirements of 40 CFR Part 761, including 40 CFR §761.61(c). They provide durable, permanent remedies that would remove certain PCB-contaminated soils, place caps and engineered covers over other soils and treat contaminated sediments as described herein and thus effectively reduce the volume of contaminants and also reduce the mobility of contaminants that remain in the soils and sediments on a long-term basis. These remedial alternatives would also minimize the potential impact of site remedies on the surrounding community. Finally, monitoring the implementation and effectiveness of these recommended remedies is very feasible. It is very common to develop and implement inspection and monitoring programs to periodically inspect and repair engineering covers over landfills and brownfields remediation projects.

Table 6-1 presents a summary of implementation costs and discussion of other costs related to the operation and maintenance of the recommended remedies. As summarized on **Table 6-1**, in addition to the Common Elements previously described, the recommended alternatives are:

- Outfall 002 Drainage Area Soils – Alternative WMF S-1
- Outfall 002 Drainage Feature Sediments – Alternative WMF Sed-1.
- LNAPL/Groundwater – Alternative WMF LN-1.
- Common Elements – Alternative WMF CE-1.

6.2 Sequencing of Alternatives

An implementation plan will be developed during the remedial design phase. As proposed in Stantec's June 25, 2019 e-mail correspondence to DNREC and confirmed in DNREC's July 11,2019 e-mail to Stantec, the Former Fueling Facility (DE-0266) and Maintenance Facility (DE-0170) will be combined and remediation will be implemented as one project.

The phasing of the implementation of the remedial alternatives will need to be developed such that the implementation of an alternative considers potential impacts to other media. As such, soils should be remediated first in a construction sequence so that runoff from this area does not impact new or restored drainage ditches. Similarly, Former Fueling Facility soils should be addressed prior to sediments in the adjacent drainage features and Outfall 002 drainage area soils should be addressed before Outfall 002 drainage feature sediments. A detailed construction sequence will be developed for implementation of the selected remedies during the design phase.

Before these remedies are implemented, the Tide Gate Repairs/Upgrades on both the Shellpot and Brandywine Creeks should be implemented to prevent recontamination of the Site after these remedies are implemented.

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Shellpot Creek Collaboration Project Summary Report was submitted to DNREC (Wilmer Reyes) in November 2006 by SECOR International, Inc.

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